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Bleaching With Hydrogen Peroxide

The Hydrogen Peroxide—Its Specifications—The Alkali—Action of the Alkali—The Bleach Bath—Temperature—Underbleaching—Overbleaching—Harshness—Spoilage

By H. G. SMOLENS

[EDITOR'S NOTE: The author of this article, who has had considerable experience with the use of peroxides in bleaching and has made a study of their action from a chemical point of view, advances certain ideas which may be somewhat novel and in some instances at variance with those held by some of our readers. We will welcome any discussion or comment upon this subject or upon the present article.]

THE bleaching of textile fibers or fabrics by oxidation with H_2O_2 is primarily a chemical, possibly an electro-chemical reaction which may be expressed in its ideal form as

Coloring Compounds + H_2O_2 = Acids + H_2O (Eq. 1)

In acid solutions H_2O_2 may be a reducing* instead of an oxidizing agent; therefore, hydrogen peroxide should be used only in alkaline solutions for textile bleaching. An alkaline bath makes the ideal hydrogen peroxide bleaching reaction become

Coloring Compound + H_2O_2 + Alkali = Metallic Salts + H_2O (Eq. 2)

However, since all commercial hydrogen peroxides contain mineral acids, salts, impurities, preservatives, etc., and since commercial alkalis also contain impurities, the bleaching reaction in practice (Eq. 3) becomes as shown by Fig. 1.

It can be seen that the less unnecessary items there are in this equation the closer it comes to the ideal bleaching reaction (Eq. 2). These unnecessary items are introduced with the hydrogen peroxide and with the alkali, assuming that the water is the best obtainable.

THE HYDROGEN PEROXIDE

There are several hydrogen peroxides sold for bleaching purposes. They are made by different processes, from different raw materials. These commercial peroxides are considerably different in their actions in the bleach bath. It is essential that the bleacher should have more than a casual knowledge of commercial hydrogen peroxides. Therefore, the following specifications for a hydrogen peroxide adaptable to textile bleaching are offered:

1. *It Should Be Neutral or Only Slightly Acid.*—A comparatively high acidity requires a comparatively large amount of alkali to neutralize and thereby introduces unnecessary metallic salts into the bleach bath. Also, high acidity usually indicates the presence of other impurities.

2. *It Should Contain a Minimum of Salts.*

3. *It Should Contain a Minimum of Preservatives.*—Preservatives are put into hydrogen peroxides to inhibit the catalytic action, on the H_2O_2, of impurities in the peroxide solution. A hydrogen peroxide loaded with preservatives indicates undesirable impurities.

4. *It Should Contain No Chemicals Injurious* (in the concentrations used in bleaching) *to Textile Fibers.*

5. *It Should Be Stable in Storage for a Reasonable Length of Time.*—The stability of a hydrogen peroxide is a function of its purity. The strength at which it is sold has no bearing at all on this purity. A good hydrogen peroxide should not lose more than one to two volumes when in its original container, over a period of two to three months.

6. *It Should Not Be Seriously Decomposed in Alkaline*

*Hydrogen peroxide has been too frequently looked upon as an oxidizing agent under all conditions, and this has been due to the fact that the formula of hydrogen peroxide has been accepted as H—O—O—H. This cannot be correct since the two oxygen atoms do not act in the same way and there are reasons for believing that the formula should be H—O=O.
|
H
It is known that the valence of oxygen may be two, four, or six. Dr. H. S. Taylor, of Princeton, has produced H_2O_2 by the action of atomic hydrogen on molecular oxygen, and it is reasonable to assume that H_2O_2 can become H—O=O and H^+.

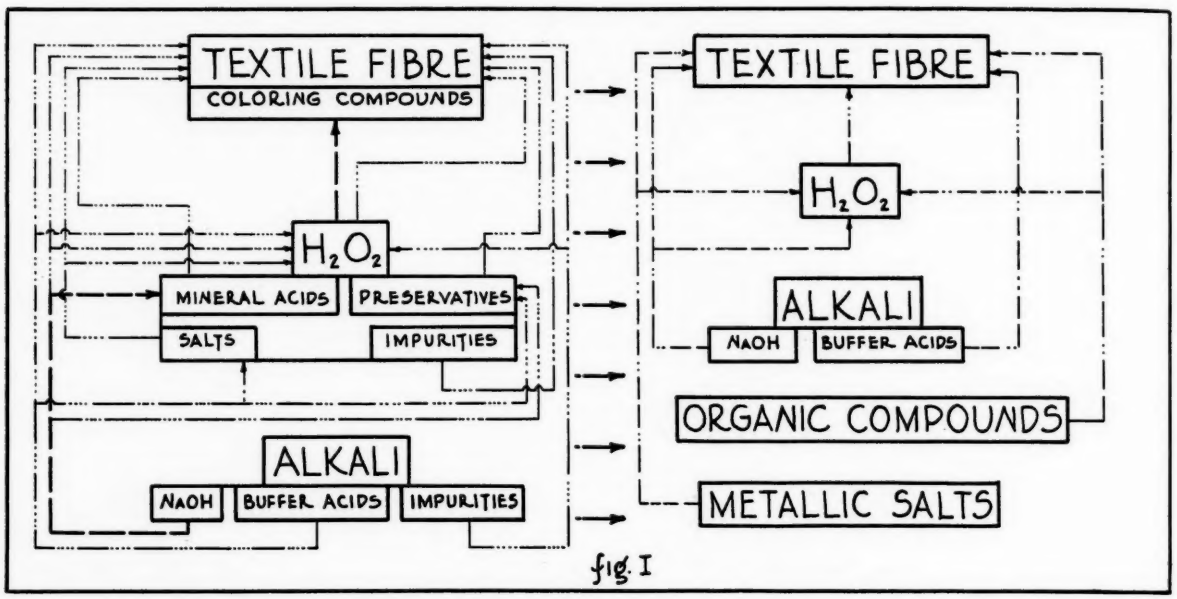

fig. I

Solutions or at High Temperatures When There Is No Bleachable Material Present.—It is desirable that the hydrogen peroxide bleach liquor be alkaline at all times, even when standing idle. Such a standing bath should show practically no loss, as the evaporation of the water should just about equal the loss in H_2O_2. When a bath is being renewed or made up at a high temperature (180 deg. Fahr.), there should be no unreasonable loss of H_2O_2.

7. *It Should Be Non-Poisonous and Non-Irritating to the Skin of Those Who Must Handle It.*

The Alkali

The choice of the proper alkali is of almost as much importance as the choice of the proper hydrogen peroxide, since the alkali plays a definite and important role in the bleaching reaction (Eq. 2). Therefore, the following specifications of an alkali adaptable to hydrogen peroxide bleaching are offered.

1. *It Must Be Readily Soluble.*—This limits our choice to the soda, potash and ammonia salts.

2. *It Must Not Have Any Severe Catalytic Action Upon* H_2O_2.—Fig. 2 shows the effect of the ordinary commercial alkalis on H_2O_2 when there is no bleachable material present. The introduction of bleachable material makes this effect more pronounced.

3. *It Must Be Non-Volatile.*—This excludes ammonia compounds from all but special bleaching.

4. *It Must Not Be Injurious to or Harshen the Textiles Fibers* (in the concentrations used in bleaching).—This limits our choice to the mild commercial alkalis such as the phosphates, silicates, and borates.

5. *It Must Be of Uniform Alkaline Concentration.*—That is, the NaOH or KOH contents must not be variable, in order that its activity in the bleach bath may be chemically controlled.

Action of the Alkali

The important activities of the alkali in hydrogen peroxide bleaching are:

1. *Neutralization of the Acidity of the Hydrogen Peroxide.*—The acid present in the hydrogen peroxide determines to some extent the alkali that can be used. Silicates should not be used with hydrogen peroxide containing hydrofluoric, hydrochloric, or sulphuric acid, if strongly alkaline bleach solutions are necessary, as fluorides, chlorides and sulphates are liable to break silicates and throw silicic acid into the bleach liquor. Silicates may, however, be used to very good advantage with hydrogen peroxide containing phosphoric acid, since phosphates do not have this tendency to the same extent. Standing bleach baths that continually become more concentrated in sulphates, fluorides, and chlorides, cannot be maintained as long or as effectively as those containing phosphates, is silicates are used as the bleaching alkali.

2. *Neutralization of Acids Formed by Action of* H_2O_2 *on the Coloring Compounds.*—The amount of alkali required depends on the hydroxyl equivalents of the acids formed in the bleaching reaction. It is necessary to control the bleaching so that the alkali does not combine chemically with or act physically on the material being bleached.

3. *Maintenance of Alkalinity of Bleach Bath at All Times.*—When the alkali in the bath is all used up by the neutralization of the above-mentioned acids, the bath becomes acid (if the bleaching has not been completed before the consumption of all this alkali). Then the ox-

idizing effect of the H_2O_2 will cease and a great many undesirable and dangerous secondary reactions may take place.

It is, therefore, highly important that sufficient alkali be used to take care of all possible requirements. Usually, it can all be added to the bath, without injury or harshness to the goods, before the goods are entered.

The Bleach Bath

It is assumed that the goods to be bleached have been previously cleaned and prepared for this process. If such is not the case, the bleaching will be uneven or otherwise unsatisfactory. Many bad bleaches, blamed on the hydrogen peroxide bath, are entirely due to faulty preliminary preparations. The scouring action of a hydrogen peroxide bleach bath, unless specially provided for (such as in the one bath degumming and bleaching of silk) is usually negligible. Bleaching (as compared to dyeing, which is probably an additive process) is the destruction, in a more or less violent manner, and the removal from the fibers, of various chemical ingredients. Therefore, a great many actions that are injurious to the goods can take place in a bleach bath, whereas the same goods will go through the dye bath without injury. For instance, rust spots that will spoil only the appearance of a dyed fiber can cause the destruction of this same fiber in the bleach bath due to the exothermoic action of H_2O_2 on various forms of iron. Insoluble soaps, usually non-injurious although objectionable in the dye bath, can cause all kinds of trouble in hydrogen peroxide bleaching.

The hydrogen peroxide bleach bath consists of water, hydrogen peroxide and alkali. Everything else being equal, the use of soft water will result in a cleaner white, and leave the fiber in better condition. If the hydrogen peroxide contains a comparatively large amount of acids it is desirable to add the alkali before adding the hydrogen peroxide, if the bleach vat or machine is sensitive to acids. If a solid alkali is used, it is advisable to dissolve it in the kettle before the peroxide is added. As far as the bleaching action itself is concerned, it makes no difference whether the alkali or the hydrogen peroxide is added first. The amount of hydrogen peroxide required (see Eq. 2) depends on the weight and character of the goods to be bleached. The weight of the goods, in turn, determines the minimum quantity of bleach liquor required.

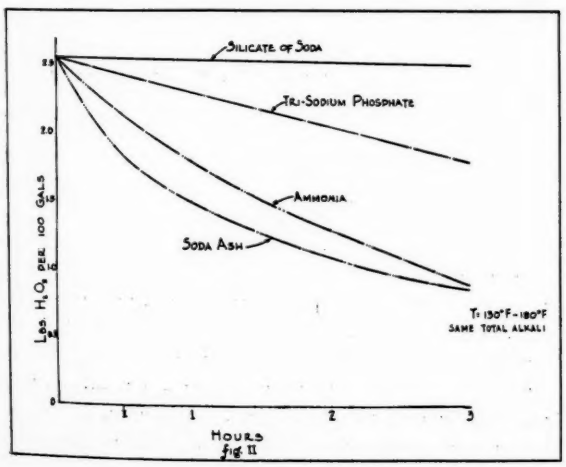

fig. II

In many bleach houses it is customary to figure the hydrogen peroxide as a fixed percentage of the weight of the goods. This is correct only when the gallons of bleach liquor per pound of goods is kept constant. Usually, the size of the lots will vary between wide limits, whereas the quantity of bleach liquor (especially in a standing kettle) is fixed. In such a case the concentration of H_2O_2—i. e., the pounds of H_2O_2 per gallon of bleach liquor—will vary widely and the quality of the bleach will vary accordingly. Therefore, it is usually more advantageous to have the bleach liquor of exactly the same H_2O_2 concentration—i. e., to figure the hydrogen peroxide on the quantity of bleach liquor. A good hydrogen peroxide will show about the same efficiency whether the kettle is fully loaded or not. Working a hydrogen peroxide kettle of uniform concentration makes the H_2O_2 control very easy. This is done by means of a burette and a standard permanganate solution. (See Fig. 3.) A kettle operator who has never before seen a burette can very quickly learn to titrate a bleach liquor. Such a titration will take only a few minutes and is well worth the time.

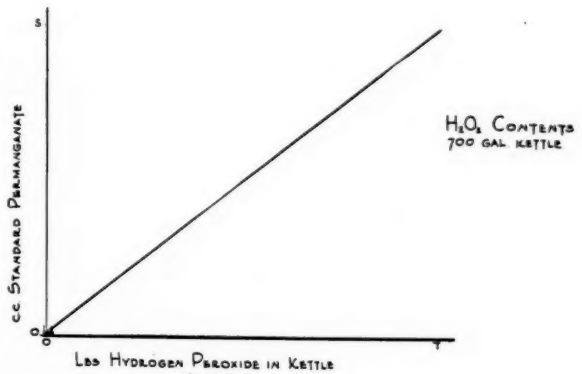

fig. III

The concentration of H_2O_2 to use depends on the nature and the condition of the material to be bleached and on the type of apparatus used. Some silk mixed goods, for example, can be bleached in a quarter volume liquor; others will be only partially bleached in a three volume bath. With a chemically controlled kettle, the hydrogen peroxide component is flexible and can be readily adjusted to the material at hand. The recording of bleach kettle operation is invaluable in the successful bleaching of any kind of fiber.

The alkali control of the bleach bath is of even more importance than the H_2O_2 control, because uncontrolled alkali can do more damage than uncontrolled H_2O_2. This

is done by means of a burette and standard acid, but it is absolutely essential that the proper indicator be used. (See Fig. 4.) Otherwise, the quantities will be comparative, not actual, and the totals may be wrong.

The amount of alkali required (see Eq. 2) depends on the amount of bleachable coloring compounds. Since the amount of H_2O_2 required is also proportional to the bleachable coloring compounds there should be a definite relationship between the H_2O_2 and the alkali. This can be seen by writing Eq. 2 as follows:

Coloring Compounds + H_2O_2 = Acids + H_2O
Acids + Alkali = Metallic Salts + Water

The Amounts of H_2O_2 and Alkali Consumed in Bleaching Are Directly Proportional.

Since the total amounts of these ingredients can be determined in any bleach liquor at any time the ratio of their consumption can be figured. Therefore, the bleach liquor should be made up with the hydrogen peroxide and alkali in this definite ratio and operated under accurately determined hydrogen peroxide / alkali ratios. Figs. 5 and 6 show how this is done. (Such a method of operation involves the assumptions that the hydrogen peroxide is neutral and that it is used up only by the bleaching and not by catalytic decomposition.) Intelligent bleaching allows each lot of goods to go into a bleach liquor that has a definite controlled concentration of H_2O_2 and alkali. Some of the advantages are:

1. Bleached goods that match, lot by lot.
2. Lower average consumption of hydrogen peroxide.
3. Minimum of bad bleaches.
4. Recognition of danger signals before any goods are spoiled.

Temperatures

When a bleachable material, properly prepared, is immersed in a hydrogen peroxide bleach liquor, there is an immediate rush of this liquor into the fiber and the reactions shown by Fig. 1 take place. The concentration of the H_2O_2 and the alkali within the fiber is soon reduced to the point at which they become inactive—i. e., there is an equilibrium condition in the bleach liquor. As the specific gravity of the bath is not materially different from the specific gravity within the fiber, circulation can be obtained by increasing the temperature of the bath. Many fibers can be bleached with hydrogen peroxide at atmospheric temperatures if the bath is kept in circulation. Some fibers must be bleached at temperatures close to boiling. In general, if goods are to be kept in a bleach liquor for the same length of time, the lower the temperature at which the bleaching will take place,

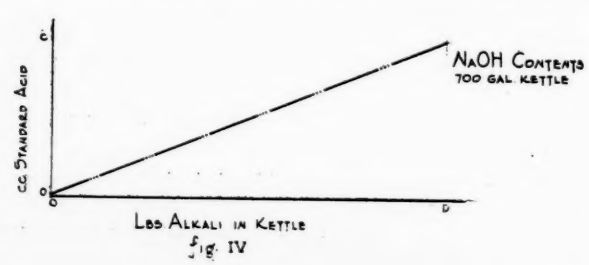

Fig. IV

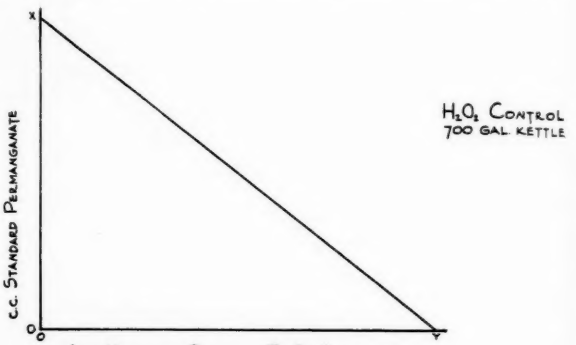

Fig. V

the better the final condition of the goods. The temperature at which any particular bleaching should be done must take into consideration: (1) The nature of the fiber to be bleached; (2) the speed with which the bleaching is desired; (3) the minimum temperature at which the bleaching will take place; (4) the type of apparatus used. Wool hosiery, for example, can be bleached in a cold hydrogen peroxide liquor in a standing kettle in about 12 hours; in a standing kettle at 120 to 130 deg. Fahr. in about two to six hours; in a Monel-metal paddle machine at 180 deg. Fahr. in forty minutes. As no two bleach houses are exactly the same, the bleaching temperature is usually a local condition.

Underbleaching

Sometimes goods are put into bleach, and in the usually required time the white is not up to sample. Most bleachers in such case will add hydrogen peroxide until they get the desired whiteness or else will pull the plug and rebleach. In practically every case of this kind the proper tests of the liquor will show that: (1) The hydrogen peroxide has not been active at all; (2) the peroxide has been decomposed and dissipated by catalytic action; (3) the alkali has been inactive; (4) the alkali has been entirely used up; (5) the temperature is too low. (The correct diagnosis of underbleaching saves time, money and energy.

Overbleaching

A hydrogen peroxide bleach bath, properly prepared, is ordinarily harmless to the fiber being bleached. However it is not very difficult to prepare a bleach liquor which can destroy the toughest of fibers. Concentrations of H_2O_2 or alkali, which alone will not harm goods, can be very violent in their action when both are brought together in a bleach liquor. For example, straw braid

steeped in ten volume hydrogen peroxide or washed in 5 per cent soda ash will not be materially harmed, but the same straw bleached in a ten volume hydrogen peroxide, 3 per cent soda ash liquor will be seriously affected. Overbleaching results when the hydrogen peroxide, the alkali or both attack the fiber structure itself while bleaching out the color which is to be removed. Intelligent chemical control of bleaching will reduce overbleaching to a minimum.

Harshness

There are at least two kinds of harshness that goods can acquire during hydrogen peroxide bleaching. One is due to chemical changes in the fiber; the other to physical additions to the fiber.

If the H_2O_2 oxidizes the fiber or if the alkali chemically combines with one of the ingredients of the fiber structure, harshness will result. This is rather a serious conditions because it is permanent.

When goods are removed from a peroxide bleach bath the fibers are filled with all the chemicals that the bath contains. Rinsing will remove practically all of the insoluble components but only so much of the soluble components as to equalize the specific-gravity of the solution in the fiber, with that of the rinse solution. Upon subsequent drying the salt solutions in the fiber are evaporated and the solids remain, causing harshness. Crystalline solids harshen goods more than amorphous solids.

Chemical harshness can be prevented by accurate chemical control of the bleach liquor. Physical harsh-

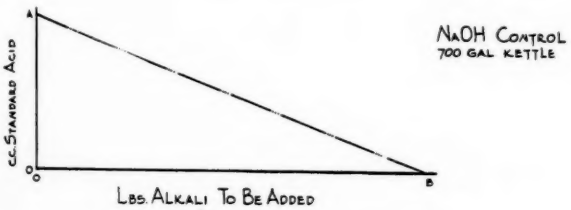

Fig. VI

ness can be reduced by the use of pure hydrogen peroxide and the selection of the proper alkali. The unnecessary items shown in Fig. 1 are the causes of physical harshness.

Spoilage

Only too frequently a lot is taken out of a peroxide bleach liquor showing spots of various kinds, streaks, holes, burns, tenderness, etc. These conditions occur usually in only a small portion of the lot, but sometimes the entire batch is affected. Naturally, the bleach bath is blamed for the damage, but only in rare instances is the blame justified. It must be realized that bleaching is a comparatively severe treatment and that during this treatment the goods are unusually susceptible to damaging secondary reactions. Every bleacher knows something about the trouble caused by various metallic impurities, dirt, oil, strong alkali, etc., which may get into the bleach liquor. Many bleachers know how to examine goods for causes of trouble before they are put into the hydrogen peroxide bleach liquor. To determine scientifically what causes the injury to goods in peroxide bleaching is usually unnecessary but the bleacher must be able to eliminate these causes. If an entire batch is spoiled it will usually be found that the entire kettle liquor has become dangerously infected. Chemical control of bleaching is invaluable in showing up such a condition before any goods are spoiled. If a small portion of a batch is spoiled the cause will usually be found somewhere in the processing of the goods previous to the bleaching. Spots can be due to iron or copper stains, oil stains, uneven penetration, faulty scouring, dye stains, insoluble soap stains. Holes and burns may be caused by metals such as iron, copper, zinc, and aluminum which may have got into the fiber. When H_2O_2 acts on even infinitesimal quantities of these metals enough heat is produced to burn the fiber. Usually, but not always, the burnt spot is stained, which gives some clue to the cause. Tests should always be made for these metals in such cases. Tenderness is usually due to corrosion by alkali or acid. Insoluble soaps caught on the fiber will bring about such an effect. Drying after inefficient rinsing can also cause tenderness.

Spoilage during peroxide bleaching is always blamed on the bleacher. In justice to himself and his firm he should be able, when necessary, to trace such spoilage back at least to the entrance of the goods into the bleach house. Simple scientific control of hydrogen peroxide bleaching, and recording of data obtained with such control, has practically done away with spoilage in many bleach houses.

AMERICAN DYES DRIVEN FROM TRADE IN BATAVIA

The value of batik produced by the natives of Netherlands India in 1925 amounted to approximately 60,000,000 florins. In that same year there were imported dyes valued at 4,832,978 florins, of which alizarine dyes totaled 692,568 florins, aniline dyes 2,748,125 florins and synthetic indigo 1,392,285 florins. (Value of one florin in United States currency equals $0.40.) Practically all these dyes, according to Trade Commissioner Donald Renshaw, of Batavia, came from Germany and were used in making batiks.

During the war the United States sold dyes in Netherlands India, but the market is now completely in German hands. The German manufacturers maintain men in the field who are constantly visiting the villages where batik is produced, consulting with the natives and offering new colors. This intensive work on the part of the Germans has completely driven American dyes from this market.

The Specific Action of the Various Acids on Wool

Part II

(*Continued from page 520*)

The Action of Sulphuric, Hydrochloric, Phosphoric, Nitric, Chromic, Acetic and Tannic Acids on Wool

By CHAS. E. MULLIN, M.Sc., F.A.I.C.

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WHILE the aluminum chloride commonly used in the aluminum chloride carbonizing process on wool is most certainly not an acid, its high dissociation in aqueous solution makes its action upon both the wool and vegetable matter approach that of a dilute and highly buffered hydrochloric acid solution. As the aluminum salt on the fiber is more or less decomposed on the fiber by the heat in the carbonizers, with the evolution of hydrochloric acid gas, here again we have the action of hydrochloric acid on the fiber from this salt.

As both aluminum and wool act as amphoteric colloids* under certain conditions, and serve as buffers in either acid or alkaline solutions, it is readily understood why in carbonizing the action of aluminum chloride solution is less drastic than that of sulphuric acid. In the first place the acid strength or hydrogen ion concentration of the aluminum chloride bath is entirely due to hydrolysis of the aluminum chloride, and even if a slight trace of free acid is present in the aqueous solution, its injurious effects upon the fiber are largely if not entirely overcome by the buffering action of the aluminum salt present. Without doubt the aluminum present on the fiber, either as chloride, basic chloride, hydrated hydroxide, hydroxide or oxide, has a decidedly protective action on the wool throughout the whole carbonizing process, and is a large factor in the better appearance, handle, and textile properties of the properly carbonized stock.

On the other hand, in a fresh sulphuric acid bath, there is usually very little buffer present and the resulting higher hydrogen ion concentration of the carbonizing bath is very probably to some extent the cause of the less desirable properties of the carbonizing wool. Without doubt many of the faults frequently attributed to aluminum chloride processed wool are due to the improper handling of the process in many plants. Possibly the slightly yellowish color of sulphuric acid carbonized stock, as compared with that of the aluminum processed wool, may be due to the greater acidity of the sulphuric acid carbonizing bath. See Fort, *J. Soc. Dyers and Colourists 32*, 184-187 (1916), upon the discoloration of wool. This paper will be considered more in detail later.

The author has found that on treating wool with aqueous solutions of various highly hydrolyzable inorganic salts, such as magnesium or aluminum chloride, a certain amount of acid is removed from the solution, leaving more or less of the "basic" salt in solution. This is entirely as would be expected from the hydrogen ion concentration of the solution, as well as from the fact that the stock always contains some alkaline ash as it enters the acid solution.

For the action of hypochlorous acid (HClO) on wool, see chlorine. Hypochlorous acid appears to be formed when chlorine is absorbed in water according to the equation: $H_2O + 2Cl = HCl + HClO$.

Phosphoric Acid

Thanks to the recent work of Loeb, Bogue, Speakman and others, we now have reason to believe that the action of phosphoric acid upon wool, at any given hydrogen ion concentration, will be similar to that of sulphuric, hydrochloric, or acetic acid at the same pH. Table XLIV, by Speakman, *J. Soc. Dyers and Colourists 40*, 410 (1924), gives the amount of phosphoric acid which combined with wool at various hydrogen ion concentrations, according to the work of Dietl.

TABLE XLIV

Amount of Phosphoric Acid Combined with Wool at Various Hydrogen Ion Concentrations, as Calculated by Speakman from the Work of Dietl

Hydrogen Ion Concentration (Normality)	C.C. Normal Phosphoric Acid Absorbed by 100 Gms. Wool
0.0010	12.57
0.0019	18.99
0.0038	33.51
0.0088	67.92
0.0158	103.8
0.0272	149.7
0.0336	165.0
0.0434	189.9
0.0551	305.9
0.0821	378.3

—Speakman, J. Soc. Dyers and Colourists 40, 410 (1924).

M. Romieu, *Compt. rend., 180*, 875-877 (1925), states that on warming keratin, dried albumin, fresh egg white, fibrin or casein with syrupy phosphoric acid, a garnet-red

*See American Dyestuff Reporter 15, 534, 535 and 577 (1926).

color is obtained which changes to violet. Mucin, nuclein and haemoglobin give a very similar coloration, but the reaction is not given by gelatin, tyrosine or phenylalanine. Tryptophan also gives the reaction.

Nitric Acid

As might be expected, the action of nitric acid on wool differs more or less from those previously discussed. A part of this different action is apparent as a yellowing of the fiber by the acid. F. Lieber, *Biochem. z. 145*, 535-559 (1924), reports that from a quantitative study of the nitration of proteins, including keratin, silk fibroin, casein, albumin, edestin, and blood fibrin, with nitric acid varying on concentration from 5 to 60 per cent, it is concluded that in each case the process consists of the formation of the mononitro derivatives of the tryosine residues. If tryptophan is also present, as in casein and blood-fibrin, this amino acid also gives rise to a mononitro derivative. Nitrofibrin and nitrocasein are reduced to colorless products by sodium hydrosulphite in a current of hydrogen in the presence of sodium carbonate.

Bowman, *loc. cit.*, page 198, states that when wool or any horny tissues are heated with nitric acid, the fiber swells, becomes yellow in color, and ultimately dissolves in the acid solution. When ammonia is added to neutralize the acid, the yellow solution becomes darker, and at last assumes an orange tint. He says that Van Laer (reference not given) is of the opinion that in the first instance xanthoproteic acid is formed, then saccharic acid, and finally oxalic acid. Bowman mentions the use of nitric acid for printing yellow on wool, especially on an Indigo dyed ground, which is destroyed by the action of this acid. The stain is quite permanent. Von Georgievics, *loc. cit.*, mentions that it is also used to produce yellow selvedges in cloth.

Vignon and Sisley, *Compt. Rend. 113*, 701-704 (1891), investigated the action of nitric and nitrous acids, both alone and combined, upon wool and silk. In reporting their results they speak principally of silk but state, as would be expected, that wool acts in an exactly similar manner when treated with nitrous-nitric acid. Their results differ considerably from those obtained by Mulder.

They found that the yellow color caused by the action of the acid is best produced by immersing the fiber for about a minute in nitric acid of 1.133 specific gravity (26.6 deg. Tw.) at 45 deg. Cent. (113 deg. Fahr.). The characteristic deep yellow color which immediately develops is fast to washing with water. It is not readily affected by exposure to air and light, and is greatly intensified by steeping the fiber in alkali, but the original shade is restored by acids. In Lyons, France, this color on silk is called Mandani or Nitric Acid Yellow. While nitric acid free from nitrous acid does not produce any coloration, as above, on adding a small amount of sodium nitrite it gives a strong yellow coloration, which is intensified by increasing the amount of nitrite, the concentration of the solution, and the temperature. However, when carried beyond a certain point the fiber is quickly damaged.

The color obtained by the combined action of nitric and nitrous acids is rendered darker by alkalies, and a portion of the alkali is combined with the fiber, as would be expected in consideration of the hydrogen ion concentration, and may be detected in the ash. The change in shade of the yellow varies with the alkali used, ammonia giving the lightest and barium hydroxide the reddest shade of yellow. Incidentally, it does not appear to make any difference in the shade obtained, whether the particular alkali used is in the form of its hydroxide or carbonate.

Wool or silk treated with nitrous acid (sodium nitrite and hydrochloric acid) acquires a pale yellow color which is not at all fast, the shade rapidly changing to a pale brown on exposure to light. This reaction, which is in truth a diazotization of the free amino groups in the fiber molecule, has been used in sensitizing both wool and silk for photographic purposes, which will be considered in a separate paper. Vignon and Sisley found that this pale yellow color is changed to brown by boiling water or alcohol, without liberation of nitrogen. Alkalies develop a reddish-brown coloration. On treating this unstable pale yellow color with pure nitric acid, a permanent yellow color results and this same permanent effect is obtained upon silk previously treated with nitrogen dioxide (NO), or tetraoxide (NO_2), in an atmosphere of carbon dioxide.

Permanganic acid (potassium permanganate and hydrochloric acid) also develops a stable yellow color on silk treated with nitrous acid, identical with that produced by pure nitric acid. V. and S. believe, therefore, that the nitric acid simply acts as an oxidizing agent, and say that the reaction which produces the characteristic stable yellow color on wool and silk requires the presence of nitrogen dioxide, tetraoxide, or nitrous acid, in conjunction with nitric acid as an oxidizing agent. This is substantiated by the fact that the nitrous-nitric acid color on the fiber is slowly decolorized by a concentrated hot solution of stannous chloride or chromous chloride. Alkaline reducing agents do not have the same effect.

Analyses of pure silk, as compared with the same fiber after the nitrous-nitric acid treatment, are given in Table XLV. It will be noticed that the treated fiber is higher in nitrogen than the normal fiber, as we would expect on the basis of chemical combination, but Vignon and Sisley believe that the nitrogen first enters into combination with the protein in the form of nitrogen dioxide, changing afterwards by oxidation into nitrogen tetraoxide.

TABLE XLV

Analysis of Normal and Nitrous-Nitric-AcidColored Silk

	Pure Silk	Colored Silk
Carbon	48.3%	46.8%
Hydrogen	6.5	6.5
Nitrogen	19.2	21.6
Oxygen, by difference	26.0	25.1

They also believe that carbonyl (CO) groups are eliminated during the reaction, with the formation of carbonic or oxalic acid. The fiber gained 2 per cent in weight during the coloring reaction. The yellow color on wool produced by nitric acid or diazotization is partially removed by stoving, but not by boiling with sulphuric acid.

Professor Olney, "Textile Chemistry and Dyeing" (1914), mentions that certain dyestuffs may be stripped from wool by boiling with dilute nitric acid. Care must be taken that the acid is not too strong or it will yellow the stock, and the boiling should not last over three or four minutes.

Lloyd, *J. Soc. Dyers and Colourists 29*, 261 (1913), after investigating the action of nitrates and nitric acid on silk, believes that the dark color on silk may be caused by oxidation of the protein by the acid, with the production of some nitrous acid, which diazotizes the amino group of the fiber with the production of the yellowish-brown color on the silk which is generally stated to be due to the action of nitric acid. Undoubtedly the same reaction, or series of reactions, cause the yellow color on both wool and silk. Whether this reaction occurs according to Lloyd's theory or not remains to be proven, for Vignon and Sisley, *loc cit.*, state that nitric acid free from nitrous acid does not give the yellow coloration.

Matthews, "Textile Fibers," page 148, points out that the action of nitric acid on wool is different from that of the other acids, in that unless the acid is very dilute and the temperature low, the fiber becomes yellow, which is probably due to the formation of xanthoproteic acid. This yellowing of protein matter by nitric acid is characteristic of these compounds, as evinced by skin in contact with this reagent. Matthews states that below 4 deg. Tw. (1.020 Sp. Gr., 3.7 per cent HNO_3) the yellowing action is slight and that nitric acid has been used in this manner as a stripping agent, particularly on shoddy.

Nitrous Acid

The action of nitrous acid on the primary amino compounds is well known and was mentioned in connection with the paper upon "The Amino and Carboxyl Group and Sulphur in Wool"* as well as in the preceding paragraphs. In an acid solution, nitrous acid diazotizes these amino groups in both silk and wool, so that they may be coupled with various phenol or naphthol developers to give a wide variety of colors. Apparently this process does not offer any commercial possibilities in wool dyeing, but is so novel, interesting and little known that it will form the subject of a separate paper.

We might say here, however, that nitrous acid renders wool harsh and non-hygroscopic, which indicates that the amino group in the fiber may play some part in connection with the hygroscopic properties of the fiber. The diazotizing reaction, by blocking the amino groups, increases the affinity of the fiber for basic dyes while its affinity for acid dyes is reduced.

Bowman, "The Wool Fiber" (1908), page 290, states that nitrous acid diazotizes wool in the same manner as any other amino compound, and it may then be developed in an alkaline solution of a phenol or naphthol into a variety of shades, depending upon the reagent used. When dyed in connection with metallic salts as mordants, these developed colors are fast to boiling water, fulling, acids and light. Tin mordants give orange and yellow shades, iron dark browns and olive browns, aluminum orange, and chromium and copper garnet.

Chromic Acid

The action of chromic acid upon wool is of considerable importance in connection with mordanting and will be considered later in more detail. See the action of the salts and metals upon wool, and wool mordanting.

Bowman, "The Wool Fiber" (1908), page 290, says that chromic acid is absorbed by the wool fiber and a compound formed with it.

Matthews, *loc. cit.*, page 148, states that chromic acid is absorbed by wool in the same manner as the other acids, and that no doubt the usefulness of bichromates as mordants for wool depends somewhat on the chemical combination between the fiber and the chromic acid.

Meunier and Chambard, *J. Soc. Leather Trades Chem. 8*, 327-329 (1924), state that the absorption curve of pelt for chromic acid from pure solutions of chromic acid is of the same form as that for any other acid. More chromic acid was absorbed when some dichromate was present than when the whole of the chromic acid was liberated from the bichromate.

Acetic Acid

As previously stated, the action of the acetic acid on wool is exactly the same as that of most of the inorganic acids at the same hydrogen ion concentration. However, due to the fact that acetic acid is a much weaker acid, i. e., much less dissociated in aqueous solution (see Tables XXXV-C and XXXV-D) than the mineral acids, a much greater quantity of it must be present to give the same hydrogen ion concentration than is the case with the much more highly dissociated mineral acids. For this reason it is largely employed in many textile processes, such as dyeing, etc., and is commonly considered to be much less injurious to the fiber than the mineral acids. Undoubtedly, at the same concentration of hydrogen ions, the only true measure of acidity, it is just as energetic in its action upon the proteins, wool included, as the mineral acids.

On account of its supposedly less injurious action on the fiber, it is widely used in dyeing the better grades of wool, and is supposed to give more level and better penetrated colors than when sulphuric acid is used. In view of Scott's previously mentioned work on silk, as

*American Dyestuff Reporter, August 9, 1926.

well as experiments by the author on wool with the common acid dyestuffs, it appears entirely possible that exactly similar results in every way, that is, as regards fiber injury, leveling and penetration, as well as dye bath exhaustion, may be obtained by the use of sulphuric acid, properly buffered to the same hydrogen ion concentration, in the dye bath as with acetic acid.

Bowman says that acetic acid produces little action upon wool beyond destroying the luster of the fiber, but causes it to swell, and when aided by heat and time, will disintegrate the fiber.

Lloyd, *J. Soc. Dyers and Colourists 28*, 337-340 (1912), gives Table XLVI comparing the amounts of acetic acid absorbed by various keratin fibers under similar conditions at various concentrations. The percentage of acid as given in the first column is based upon the weight of the fiber present. This table is comparable with Table XXXVII by the same author, giving the same data for sulphuric acid:

TABLE XLVI

Absorption of Acetic Acid by Various Animal Fibers.

Percentage of Acetic Added	Percentage of Acid Absorbed				
	Cross-bred	Down Top	Alpaca	Mohair	English
5.0	1.80	2.58	2.19	2.10	1.82
5.5	2.60	3.03	2.54	2.41	2.28
6.0	2.99	3.64	3.08	3.01	2.79
6.5	3.52	3.77	3.48	3.29	3.29
7.0	3.91	4.35	3.97	3.78	3.69
7.5	4.36	4.70	4.32	4.23	4.15

Mardles, *Biochem. J. 18*, 215-230 (1924), found that the solubility of gelatin is greater in a mixture of acetic acid and water than in either alone, and that the solubility of gelatin in acetic acid is considerably increased by the addition of phenol and benzyl alcohol, which by themselves are not gelatin solvents under ordinary conditions.

Acetic Anhydride

Munz and Haynn, *Chem.-Zeit. 46*, 945-946 (1922), state that when wool is treated with acetic anhydride in the presence of a catalyst, such as hydrochloric acid, phosphoric acid, organic sulphonic acids, and particularly sulphuric acid, it retains its physical properties, except that it can be more easily "milled," but it permanently resists acid dyestuffs, so that white effects in piece dyed goods are possible. The treated wool contains no sulphuric acid and when heated with 50 per cent sulphuric acid, yields no acetic acid by hydrolysis. In treating wool by this process, the injurious action of the sulphuric acid on the wool may be diminished, without reducing its catalytic action, by neutralizing a part of it with a weak organic base such as pyridine or dimethylaniline. The wool may also be padded with sulphate of aluminum or chromium, or rather easily dissociated salts of sulphuric acid. Previously dyed wool may also be treated, but the consequent decrease in fastness to washing, milling, etc., must be corrected by afterchroming. Wools dyed with the acid alizarine dyes are considerably altered in shade.

The resisting process may be conducted in rotating, water-jacketed, closed aluminum drums. For each kilogram of undyed wool, one liter of acetic anhydride, 4 liters of acetic acid, 140 grams of sulphuric acid (monohydrate), and 77 grams of dimethylaniline are used. In treating dyed wool, the sulphuric acid and dimethylaniline are replaced by 60 grams of sulphuric acid (monohydrate). The stock is worked for an hour and a half at 57 to 58 deg. Cent. (135 deg. Fahr.), and is then washed and dried. In the case of dyed wool, after washing, it should be treated with a solution containing 20 per cent of 20 deg. Be. (1.16 Sp. gr.) chromium acetate solution and 4 per cent of 85 per cent formic acid for 45 minutes at 75 deg. Cent. (167 deg. Fahr.), then washed and dried. The acetic acid used in the treatment may be recovered as a 30 per cent solution, and is suitable for use in dyeing and mordanting.

Formic Acid

Undoubtedly the remarks on acetic acid also apply to formic acid which is also sometimes used in dyeing high-grade materials. Its action on the fiber, and in exhausting the dye bath, will be entirely in proportion to the hydrogen ion concentration of the bath, time and temperature being constant in all cases, of course. (See Table XXXV-C.)

Other Organic Acids

Bowman, "The Wool Fiber" (1908), page 290, says that the organic acids, such as oxalic, tartaric, acetic, etc., are all absorbed, except in the case of tannic acid, which is very sparingly absorbed.

TABLE XLVII

Amount of Oxalic Acid Combined with Wool at Various Hydrogen Ion Concentrations, as Calculated by Speakman from the Work of Fort and Lloyd.

Hydrogen Ion Concentration. (Normality)	C.C. Normal Oxalic Acid Absorbed by 100 Grams of Wool
0.0003	21.0
0.0012	38.4
0.0024	54.6
0.0036	70.1
0.0056	80.3
0.0075	90.3
0.0087	103.8
0.0104	114.8
0.0186	124.8
0.0211	128.2

—Speakman, J. Soc. Dyers and Colourists 40, 410 (1924).

Tannic Acid

Bowman, "The Wool Fiber" (1908), page 290, says that tannic acid is only sparingly absorbed from solution

by wool, but if it is applied at the boiling temperature and afterwards treated with tartar emetic (antimonial potassium tartrate), the affinity of the wool for basic dyestuffs is increased. The natural tannins have been recommended for the purpose of increasing the tensile properties of wool, but it is doubtful whether they have much practical value on a commercial scale. Also see the discussion upon the protection of wool in a later paper.

According to German Patents No. 354,945, No. 355,533 and No. 382,085 to W. H. Schweitzer, the natural and synthetic tannins may be used upon chlorinated wool to give "a sort of a tanned product." The change in the fiber becomes more pronounced as the oxidizing effect of the chlorine has been greater. They state that the particular effect to be obtained may be controlled by the additional use of aldehydes. For a leather-like effect on woolen cloth that has been milled, the material is treated with an aqueous hypochlorite solution acidified with hydrochloric acid by padding and squeezing between rollers. It is then washed and treated with a boiling tanning solution, such as the condensation product of phenolsulphonic acid and formaldehyde, commercially known as Neradol. By the same process strong alkalies may be used in place of the tanning solution, as mentioned in United States Patents No. 1,389,274, No. 1,389,275 and German Patent No. 382,085.

German Patent No. 381,418, January 22, 1922, to F. Just, assigned to Meister, Lucius and Bruning, states that the addition of natural or artificial tanning agents to the materials used for fulling textile materials reduces the time necessary for the filling process.

As in the case of the action of many other reagents upon wool and related proteins, the action of tannic acid (or tannin) upon leather has been investigated much more fully than its action upon the wool fiber. However, as the essential reactions are probably the same in the case of leather and wool, the leather investigations on the action of the tannins may be of interest in our study on wool.

In this connection the best treatment of the subject available appears to be that of Dr. J. A. Wilson in "The Chemistry of Leather Manufacture," New York (1923), from which the following is quoted with the kind permission of Dr. Wilson. As mentioned previously in regard to several other books, "The Chemistry of Leather Manufacture" is of considerable interest to all textile chemists in the study of wool, as most of the very detailed and complete information in this book applies more or less directly to the related proteins, including wool.

Wilson, Chapters 11, 12 and 13, divides the tannins into two groups, the *pyrogallol* and *catechol* tannins and proceeds to show that they differ considerably in some of their properties and reactions, as well as in constitution. At the present time, he believes that it is impossible to apply organic chemistry to practical tanning with these reagents, owing to the lack of definite knowledge on the structure of the tannins.

In textile chemistry there does not appear to be any differentiation made between different varieties of tannin although Wilson shows that the colors obtained with the ferric salts vary considerably with the two varieties. However, all tannins seem to have the property of precipitating gelatin from solution and of combining with the protein matter of hide fibers, so that we may assume that they also all unite with wool in the same way. He shows that as in the case of all other protein combinations, the amount of tannin in combination with the protein is controlled by the hydrogen ion concentration of the solution.

It is interesting to note here that Wilson, page 273, believes that collagen and tannin may combine in the proportion of 45 of tannin to 100 of collagen, as well as of 90 to 100. He assumes 750 as the equivalent weight of collagen and 340 as the combining weight of the digalloyl radicle. On this basis, 340 parts of tannin combine with 750 parts of collagen, or in the ratio of 45.3 to 100 of collagen. It is interesting that this proportion very closely approximates the lowest proportion of tannin usually found in fully tanned leather. The highest proportion of combined tannin usually found in tanned leather is about twice this, or 90 parts of tannin to 100 of collagen. The maximum reactivity of tannin for collagen appears to be between pH 2 and 5. It would be interesting to see just how this would work out in the case of wool.

Tannin has also been used in order to obtain resist effects on wool, and in this connection it is interesting to note that Wilson and Bear, *Ind. and Eng. Chem. 18* 84 (1926) report that on leather an increasing degree of vegetable tannage causes a corresponding decrease in the capacity of collagen to combine with sulphuric acid. Evidently the combination of the tannic acid with the basic groups of the wool is strong enough to withstand the sulphuric acid treatment. Therefore it is not surprising that the wool is not dyed in an acid dye bath.

(This closes the eleventh paper of the series on "Wool" by Chas. E. Mullin, and completes the study of the action of acids on wool. The next paper will deal with the action of the alkalies. It will appear in an early issue. This will be followed by papers upon the action of various other reagents upon the wool fiber.)

POLISH DEMAND FOR DYESTUFFS INCREASING

With the improvement in general economic conditions, and especially in the textile industry, the demand for dyestuffs in Poland is increasing rapidly. Local production, which now runs around 1,000,000 kilos a year, covers only a part of the demand, and heavy imports are coming from Italy, Switzerland, and especially Germany. Some Polish exports have gone to Russia, Latvia and the Baltic States, but in these markets Polish dyestuffs are meeting with strong German competition, which at present threatens entirely to eliminate the Polish product. (Assistant Trade Commissioner L. J. Cochrane, Warsaw, Poland.)

The Function of Enzymes in Bleaching and Dyeing

The Enzymes' Work in Textile Processing—Enzyme Solution Quick in Action—Two Kinds of Enzyme Products Available—Mechanical Operation of the Enzyme Treatment

By George Rice

ENZYMES are chemical matters held by living cells, and each is physically fitted to function in some way in the bleaching and dyeing of anything that can be bleached or dyed. Technically, an enzyme is a biochemical catalyst that aids in the deterioration of substances in textiles which it is desired to eliminate in order to help produce an efficient bleach or dye on the goods. That is, a body of this bacterial matter is capable of making gummy ingredients, starches, pectins, proteins, waxes, weighting, binding, stiffening and general sizing compounds soluble in water. In the manufacture of fabrics it is necessary that various binding and stabilizing agents be employed on the yarns to make them smooth and round and insure their intactness of structure throughout the processes. It would not be possible to get soft, lightly twisted, fine yarn through the harness eyes and reed splits of modern high speed looms unless binding agents were employed to glue the individual fibers firmly together. All this precaution to make yarn which will stand up well in the weaving of the goods hinders the work in the bleaching and dyeing departments. These stiffening materials are as a rule insoluble in the state in which they exist on the threads in the cloth and their elimination depends upon reducing them to a soluble state.

We attended an illustrated lecture on the function of enzymes in converting certain substances into substances of another kind. Microscopical views of the glands of the digestive organs of animals that secrete enzymes were shown on lantern slides.

The process by which the enzymes convert starch into sugar, and various glutinous substances into soluble salts was demonstrated.

A peculiarity of the enzyme body is that it is capable of accomplishing results when properly handled without losing any of its natural force. It can bring on a reaction in a strong chemical substance and come out of the affair without any perceptible alteration in its chemical construction or working properties.

An Enzyme Solution Is Quick in Action

It is possible to remove all filling, weighting, stiffening and general dressing materials from goods in a half day exposure in a solution of enzyme and about 120 deg Fahr., providing that there is no alkali in the bath. Everything of a starchy nature will be washed out, leaving the goods in condition for effective bleaching or dyeing. Where unsatisfactory results follow the enzyme bath the cause often may be traced to the presence of alkalies or powerful acids that tend to weaken or entirely destroy the enzyme body. We have seen enzymes rendered unfit for desizing purposes by running the temperature of the solution to 170 deg. Fahr. A temperature up to 150 deg. or even 160 deg. Fahr. will not interfere materially with the activities of the bacteria, but it is safer to keep the temperature around 120 or 130 deg. We refer to the enzyme as a type of bacteria, for evidently it has plenty of life. For instance, the high temperature destroys them. When dead they are not effective.

If subjected to a temperature at the freezing point the enzymes become numbed. They lie dormant until thawed in a rising temperature and then become as efficient as ever in the decomposing of substances foreign to textiles without impairing the textile material.

Two Kinds of Enzyme Products Available

There are two kinds of enzyme preparations available for the bleachers and dyers at the present time. There have been other kinds in the market in the past, but for various reasons are not used now. The war brought about certain changes in the enzyme industry. The great breweries of the country that flourished before and during the war turned out vast quantities of malt extracts that contained the diastase enzymes which were valuable to the bleaching and dyeing trades but no special effort was made to supply these trades with the material. The Prohibition act, which went into effect at the end of the war, closed the breweries and manufacturers of brewers' supplies, "revamped" their machinery to turn out new materials for industries which were permitted by law to operate. Consequently we have in textile bleaching diastafor, which is obtained from malt flours and extracts, and polyzime, which is obtained from the culture of certain species of moulds and fungus growths. Thus the textile industry has gained something in the Act of 1918 which closed the plants engaged in the manufacture of beer. The great brewers and manufacturers of brewers' supplies had high-salaried chemists in their employ. These experts turned their attention to the production of materials for use in other fields and the textile field has proven to be a rich one.

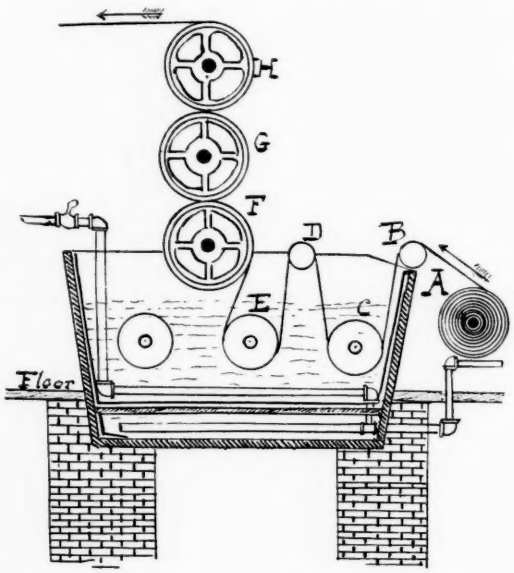
Mechanical Operation of the Enzyme Treatment

While the use of enzymes needs no special mechanical or chemical handling, most bleacheries and dyehouses have a system of operation and certain equipment with which to work. Usually the goods are left in a diatase bath a night or a day, although in some places we have seen this treatment continued but two hours.

The manufacturers of the preparations furnish details for making the bath to get the best results with the different grades of goods to be bleached. An average bath of 300 gallons of water takes 30 pounds of diastafor or polyzime. The temperature is brought to about 115 deg. Fahr. and the goods run through, full width, sometimes

in a regular liming machine or a machine specially built for the purpose.

Washing follows, and if a good white is desired for white fabrics the cloth is boiled in a fifty-fifty soda ash and caustic soda bath, soured, washed and finished. As enzymes remain intact in desizing properties for a considerable time, the same bath can be used repeatedly until it becomes quite foul. Even then it can be continued in



use for a time by adding new desizing material and fresh water.

A sectional drawing is given of a form of desizing machine on the padder plan. The goods are entered at A and are passed over the roller B down to the submerged roll C, thence over D, down again to E and then up through the squeeze rolls F, G and H and out of the machine.

By this plan the goods are given two separate submersions in the liquor and two separate squeezes in the one trip through the machine. We recall seeing a single squeeze machine in use and in order to get the cloth so that it would not drip on emerging, the pressure was far too severe and the tension and stress excessive all the way, all of which tended to impair the efficiency of the treatment. In another plant we noticed a machine running too fast, so that the liquor was splashed about the floor, causing waste of material and poor work. We were told that the boss ordered the high speed on a rush order, but finally had to run the goods through a second time in order to complete the desizing.

The French Hand Printing Company, Paterson, N. J., organized a short time ago, with a capital of $25,000, to operate a print and dye works, will be represented by Victor Delorme, 1061 East Twenty-fifth Street, Paterson, one of the incorporators.

Abstracts of the Division of Dye Chemistry Papers

American Chemical Society Meeting

THE seventy-fourth meeting of the American Chemical Society is being held during this week in the Statler Hotel, Detroit. The Division of Dye Chemistry will hold its session on Tuesday, September 6. The papers making up the program of this session are given in abstract below.

Some New Substantive Polyazo Dyes. F. F. Hitch and Francis H. Smith. The paper describes a number of new direct cotton dyes containing four or more azo groups. Some of the dyes which contain eight azo groups have remarkable affinity for vegetable fibers and possess good solubility. All of these dyes contain two or more para-amino residues and are prepared by coupling two molecular equivalents of a tetrazo body, such as tetrazo benzidine, to a component capable of double coupling such as H-acid, then combining this new tetrazo compound with two molecular equivalents of an end-component. If one of these end-components is capable of double coupling, the dye can be combined with diazo or tetrazo bodies to form dyes having one or more additional azo groups. Lantern slides of the structural formulas will be shown and sample dyeings will be exhibited.

Some Theoretical Considerations Concerning the Reduction of Azo Dyes and Nitro Compounds. J. B. Conant and F. Ewing. Previous work has shown that the concept of "apparent reduction potential" is useful in dealing with irreversible reductions such as the reduction of azo dyes and nitro compounds. A few examples of the applications of such a point of view are considered. By using an inert electrode and the usual electrochemical method of measuring potential it is possible to obtain information when titanous or vanadous chloride are used as reagents. The rate of addition of the reagent may be gauged and the products controlled to some extent, where a partial reduction is desired.

Development of Synthetic Phenol from Benzene Halides. William J. Hale. A brief description of the early attempts to hydrolyze aromatic halides and an explanation of the difficulties met by the early investigators, and a dscription also of the various results obtained in a study of bromobenzene and chlorobenzene under varying conditions of temperature, pressure, and catalyst.

Theories Regarding the Formation of Indanthrone and Flavanthrone from Beta-Amino-Anthraquinone. Ralph N. Lulek. The recent synthesis of two new anthraquinone compounds B-B'-azo-anthraquinone

and B-B'-hydrazo-anthraquinone has made it possible to prove Roland Scholl's theory of the formation of indanthrone and flavanthrone. B-B'-hydrazo-anthraquinone undergoes a rearrangement analogous to the semidine rearrangement of the benzene series and yield 2-amino-1:2'-dianthraquinonylamine and 2:2'-diamino-dianthraquinonyl, respectively, and later on indanthrone and flavanthrone. The other theories relative to the formation of flavanthrone and indanthrone are briefly discussed.

The Influence of Sulphur on the Color of Dyes. G. D. Palmer, Geraldine K. Walker, A. E. Munsell, and E. Emmet Reid. The 120 dyes which were prepared to contrast the influence of the four groups $—CH_3$, $—OCH_3$, $—SOH_3$, and $—SO_2CH_3$ have been shown and described before this division in previous papers. These dyes have now been measured with the spectrophotometer and also according to the Munsell Color System. The dominant wave length, the hue, the value, and the chroma of each of these 120 dyes have been determined. The dyed skeins and the numerical data are here presented together so as to bring out the effects of the different auxochrome groups in the different positions.

The Direct Nitration of Substituted Anilines. H. W. Post and E. Emmet Reid. Various substituted anilines have been nitrated with mixed acid, the object being to determine the amount of protection afforded by the various substituent groups in different positions. The percentage yields of the mononitro derivatives are given for the anilines containig the substituents in the positions indicated. 4-OH 72.6 per cent, 4-OH, 3-COOH 42.5 per cent, 2-OH, 3-SO_3H 40 per cent, 4-SO_3H 34 per cent, 3-SO_3H 26.7 per cent, 2-OH, 4-SO_3H 4.8 per cent, 2-OH 0 per cent, 2-OH, 5-COOH 0 per cent. The p-hydroxy-aniline is sulfonated as well as nitrated. The results are discussed from the point of view of the theories of the structure of benzene.

ULTRA-VIOLET TRANSMISSION OF CELANESE STUDIED

The United States Bureau of Standards, having received numerous inquiries as to the ultra-violet transmission characteristics of Celanese, assigned its radiometry section to carry out qualitative tests. The results are briefly given in the current issue of its Technical News Bulletin.

The tests showed that uncolored cloth of satin weave transmits but little ultra-violet light of wave lengths less than 303μ. The blue-colored voile weave readily transmits these rays. Folding the voile-weave cloth so that the light had to pass through four layers of the material greatly reduced the transmission, absorbing practically all the "vitalizing rays."

Evidently the closeness of the weave determines the amount of ultra-violet transmission. Wetting the satin weave did not appreciably increase the transmission.

The Loose Cotton Dyeing Department

The Selection of Dyes—Suitable Machinery—Drying Equipment—Direct Dyes on Cotton—Sulphur, Direct Fast and Other Series—Vat and Azoic Colors.

By "TEXTRION"

COTTON in the loose or raw stock is dyed both for all-cotton and "union" spinning purposes, for "marl" and self-shades, for hosiery and weaving yarns for a variety of purposes. The stock handled ranges from virgin cotton, such as Peru, to hard wastes of a thready nature such as "cop-bottoms," and soft wastes of many kinds, including cylinder strips; willow fly, roving waste, laps, etc.

The dyeing covers practically the same color categories as does the yarn-dyeing section and includes the production of colors fast to ordinary washing for hosieries (and often fast to light), colors fast for knitted outer wear, etc., colors for the scouring and milling woolen finishes, colors to withstand cross-dyeing, both acid and chrome, for piece-dyed woolen unions, colors to stand chlorination for shrinking processes, and bleaching finishes, etc.

As regards the technical application of the cotton dyestuff to the loose or raw stock, it is probable that taking the dyeing world as a whole the biggest consumption of dyestuffs for loose cotton is that of the sulphur series. This is because for a large variety of purposes, representing the bulk of output, the average requirements as regards fastness are met by dyestuffs of the sulphur series.

It is admitted that these dyes reveal wide discrepancies in fastness properties, and that on the whole they are comparatively sombre shades, but the fact remains that by ease of application, comparative cost, and average capacity, they "fill the bill" to such an extent as to head the consumption tables against all other classes of dyestuff.

Next in order of weight, but probably only fractionally as great, comes the direct cotton dye series; then the vat dyes, and certain smaller quantities of basic dyes, azoic dyes, etc.

Suitable Machinery

Machinery or dyeing plant ranges from the simple dyeing cistern with circulation by pole or stang to the steam circulated puffer type and through a whole

series of mechanical pump outfits (of which the Obermaier machine is probably prototype) from a few lb. capacity up to 2,000 lb. and higher.

In the writer's opinion it is possible to build machines of too large a capacity even where continuous bulk work to a shade is obtainable. From technical and labor considerations probably 1,500 lb. represents a useful limit of capacity.

For certain purposes the old style tank or cistern is still irreplaceable for certain shades, and for testing or matching small bulk before using the machinery of modern times for the weight.

Tanks fitted with reserve tanks, either under, over, or abreast, are generally used in preference to the simple single cistern. A little manipulation of dyes, wash-offs, and fixing agents, can be effected by an intelligent use of reserve, even in comparatively small lots, and this will effect economies which, being cumulative, will reflect favorably at the year end on the dyeware and chemical account.

Modern machinery, with or without loading and unloading gear, one-way or double pumps, and built in a diversity of manner, is too extensive a subject to cover in this article. It must suffice to say that machine dyeing requires strict attention to several important points, such as correct solution of dyestuffs, correct addition of same, and necessary assistants; facilities for packing the material to avoid channelling; correct, efficient circulation and easy means of unpacking; ease in matching and observance during process, etc. Among advantages are steam and floor area economy.

Drying Methods

Drying machinery is very efficient in these days and is usually of the continuous traveling creep-sheet type, with heater and fan circulator and automatic hopper feed to deliver the wet cotton in a suitably-divided condition for the drying operation.

Delivery arrangements from the outward end are made as individually required.

A reserve of heat is desirable in case of "push," and careful attention avoids either over or under condition in the dried material.

It is profitable to pay regular attention to the condition in which the wet cotton is delivered to the drying-machines. Supervision of hydro-extractors will ensure that their work is not left to be performed in the drying machines. Regularity of drying output and condition can only be maintained by attention all along the line.

In any case a little extra "whizzing" is cheaper than upsetting the drying machines by re-drying badly "whizzed" cotton.

As regards the actual dyeing processes, basic colors still find a restricted use, and are applied according to the familiar instructions. The increasing demand for light-fastness has probably helped to depress the use of basic dyes, because suitably treated they could be made fair to washing for some purposes. The basic process lent itself to the old-style cistern dyeing, though when Katanol is used as the fixing agent mechanical apparatus can be employed.

Direct Dyes

The use of the direct dyes is simple; being applicable to every plant. Light shades of this series, such as pinks, skies, creams, light green, helios, fawns, etc., can be used even for goods requiring scouring and light-to-medium milling.

Darker direct shades are apt to bleed against white cotton. It is not practicable to discuss safe depths of shade, but as a guide it might be suggested that shades equivalent in depth to a tone obtained by ½ of 1 per cent chlorayol sky-blue or equivalent—and well washed off—would resist a fair amount of piece scouring or yarn washing.

Needless to say, the direct dyes are not usually recommended for cross-dyeing requirements (wool style); but for certain fast-to-light purposes and in certain shades for washing, the colors serve a useful purpose and cover a wide range. Many colors for knitted mixed outer-wear yarns are thus obtained.

Thus the direct fast series of cotton dyes produced in the paler shades can be utilized for purposes which demand good resistance to light and considerable fastness to washing. It is good mill-practice, however, to try these shades out in test before producing yarns in bulk.

The Sulphur Series

The principal class of cotton dye is, as stated, the "sulphur" series, though these colors are also somewhat irregular in their properties. Thus blacks are excellent to light and milling and certain greens and blues are almost as good, but the remainder, such as oranges, browns, bronzes, olives, etc., are not nearly so good against light, and the yellows are somewhat worse. Nevertheless the style of application and the good fastness to scouring, milling, and cross-dyeing secures for them the principal position in consumption.

Matching of colors is especially difficult on account of the somewhat slow oxidation of the leuco color compound, and the final shade is not always shown by chroming-off the sample bit. Holding over boiling dilute acetic acid vapor seems to release the shade from alkaline reduction influences; but, of course, if the batches are required to be finally chromed-off, the approximate match can be shown by the chromed-off matching bit.

Direct fast yellows of the "B" type successfully replace the somewhat unsatisfactory sulphur yellows in compound shades for fastness to light, washing, and milling, but not acid cross-dyeing.

Such a method, however, must be used with reserve; it would not be desirable to dye shades on the heavy side with the direct yellow if the yellow was, for instance, 90 per cent of the total shade and had to be milled against white cotton. Again tests are advised.

Other methods of topping are by means of other direct dyes, by the use of certain basic dyes for a few restricted purposes, and special shades such as aniline oil-topped sulphur black, which produces heavy jet shades.

Fixation Process

It is often desired to fix the sulphide dyes without an oxidizing operation before the final wash off.

In "packing" apparatus oxidation before washing is difficult. Washing also causes loss of unfixed color if oxidation is imperfect. If the plant permits, an almost complete fixation can be affected by allowing the colored material to cool in the packed form in the machine for a couple of hours before washing. This is not always possible on account of plant restriction, but in certain big operations such as black plant can be devised to permit this "ageing" during the period that other parts of the plant are packed or unpacked, thus keeping production steady.

Cutch Vats

On account of the tinctorial weakness of the sulphur browns, yellows, etc., and their poverty, especially of "overhand" covers and the impossibility of replacing them by artificial dyes at a price, it is still good practice to retain a cutch vat for the production of economical heavy browns of good fastness to light and milling.

The cutch method has a tendency to roughen the spinning property of the staple, but this can be overcome by suitable softeners, and in right hands it is capable of yielding several shades of considerable merit. The "vat" is fitted with reserve tanks, and is preferably the old style open system. Approximately 15-20 per cent of average prepared cutch (catechu) will yield with chrome a reddish brown; with copperas, a full grey; and with bluestone, a yellowish brown. Mixtures of developers can be used; thus copperas is available as a "saddening" agent.

Other methods of topping can be used, bearing in mind that cutch "fixes" a certain amount of metallic salt than can operate as a mordant.

Cutch dyeings have a semi-waterproof action, also a rot and insect proof action, on the fiber. Furthermore, weight is added to the cotton by this means.

Advantage can be taken of the mordanting power of sulphur blacks and some colors in conjunction with chrome, iron, and possibly other metals (except copper in the case of blacks) to top with small quantities of wool-chrome colors, log-wood, etc., and, of course, cutch can be shaded with hematein, fustic, and the like.

Generally speaking, the chemical development of the "sulphur" series is not exploited, but in cases where air oxidation appears insufficient for extra fastness, "chroming" should be resorted to, subject to necessary precautions and tests.

Vat Colors

The dyeing of the vat series on raw stock is probably more largely operated in the United States than in England, but this is a type of dyeing which although expensive yields a much more extensive range of shades than does the "sulphur" series, and, obviously of a greater scope as regards all-round fastness. It is well adapted for application in mechanical apparatus, subject to technical precautions as to premature oxidation, etc., and is undoubtedly a coming vogue in raw-stock dyeing here.

Azoic Dyes

The Azoic dyes, by reason of the stability of the naphthol bases, can also be used for this class of work in apparatus, and are a welcome addition to the production of full shades of reds and kindred shades of wine, Bordeaux, etc., which are absent in the "sulphur" and deficient in the "vats" on account of tinctorial value.

In addition to the dyeing resume, only a brief allusion is necessary to other materials, such as the old-fashioned palm oil softener, still going strong, and the sulphated oils and soaps.

The underlying idea in loose cotton dyeing is to preserve the spinning property, and there are many styles of yarns and fabrics still likely to be required which need a well-managed, dyed-in-the-cotton for their successful production.—Textile Argus.

I. G. PLANS LARGE SALES CENTER

The German dye trust is planning to erect a general administration building that will center its dyestuff sales division, according to advice from the Department of Commerce. The I. G. will purchase a large tract in the northwest section of Frankfort as the site of this building.

The I. G. centers its dyes sales now in four locations, selling different world markets. Ludwigshafen sells Hungary, Rumania, South Slavia, Switzerland, Interior India, Turkey, Greece, Africa and Bulgaria, Cassella, Frankfort on the Main; France, Belgium, Luxemburg, Italy, Spain, Portugal, England, the Saar, South America, Australia, and New Zealand; Hoechst: Sweden, Norway, Denmark, Austria, East Europe, Czecho-Slovakia, North and Central America; Leverkusen: Germany and Holland.

AN IMPROVED MERCERIZING PROCESS

An improved mercerizing effect is obtained with very cold lye probably because at a lower temperature a better and more complete swelling action is obtained without the risk of the lye exerting a decomposing action. The higher is the temperature of the lye, the more rapidly does the destructive effect of the swelling agent become apparent and finally the swelling is superseded by the decomposition of the cellulose.

Attempts have therefore been made to obtain an improved mercerizing process by cooling the mercerizing bath itself. It has also been proposed after mercerizing and squeezing out the fabric to pass it over a series of cooling rollers and then stretch and fix it. In these cases it has not been taken into consideration that both during the action of the solution on the fibers, as well as during the stretching operation a considerable amount of heat is generated, so that the cooling of the treating solution cannot counteract or only to a slight extent counteract, the heat generated in the fibers, which is also the result in stretching after cooling.

A patent (262,154) taken out by E. Gmuider, of Reutlingen, concerns a method which consists in eliminating the reaction heat during the mercerizing treatment as well as the heat generated during the stretching, thus assuring that until the moment of fixing by washing with hot solutions the material is kept at a low temperature in the stretching zone itself.

The material after being saturated with the lye is passed over cooling surfaces and at the same time stretched, in order that after the mercerizing effect has been obtained, it can be washed with hot solutions while still in the stretched condition. The method can be applied for instance to webs of material in such a way that the web of material is steeped in cold lye and then passed over a pair of rollers, one of which is constructed as a transverse-stretching roller, the other as a strongly cooled roller. The device for applying the treating liquid may of course be constructed as a strongly cooled roller.

Similarly when it is a question of transverse stretching by means of chain guides, the web of material can be passed during the stretching operation over a cooled table surface or over several cooled surfaces alternately above and below. To improve the quality of hanks of yarn a cooling table over which the yarns soaked with alkali pass, can be built in between the rollers which move towards and apart, or these rollers may be themselves cooled.

It is always essential that during the mercerizing operation, the material itself shall be kept at a low temperature. The swelled cellulose is a good conductor of heat and therefore it is possible in this manner to maintain the desired low temperature in the material and to eliminate the heat generated by the reaction and by stretching. It is thus possible without any risk of the cellulose decomposing to allow the swelling action of the treating solution to proceed without any interruption until it is finished, so that the completely swollen fibrous material, that is to say, a fibrous structure having a round cross section enters the stretching zone, where it is washed with hot water or dilute lyes and fixed, so that it can be acidified in the relaxed condition.—Dyer & Calico Printer.

TEXTILE SCHOLARSHIP ESTABLISHED

Some young man or woman in the textile industry will be awarded a scholarship of $500 this week to aid his or her education along technical or cultural lines. This scholarship was recently established by the Hart Products Corporation, of New York, consulting chemists and manufacturers of textile chemicals. The Southern Textile Association has assumed the stewardship of this fund and will award it every year to some deserving young person connected with the textile industry or whose parents are connected with the industry.

The scholarship was established for the purpose of encouraging the youth of the industry to strive for higher technical or cultural achievements, and thus by precept and example to aid in advancing the ideals of the industry and guiding its personnel. All applications will be judged impartially by a committee of the Southern Textile Association in order that only those who, in the judgment of the committee, are most deserving of assistance and encouragement will benefit under its provisions.

Those knowing of some worthy young man or woman who is prevented by adverse circumstances from continuing his or her education are asked to bring this notice to their attention. Applications should be made at once to J. M. Gregg, secretary of the Southern Textile Association, Charlotte, N. C.

NEW DYES FOR TEXTILE PRINTING

A new series of dyes for use in the textile, decorative and arts trades, that are described as being of unusual fastness to light and washing, perspiration, rubbing and ironing, were recently placed on the market under the trade name of Malgo colors.

These colors are said to be especially valuable in aerograph work and silk textile printing, and are also applicable to hand painting on leather, velvet, muslin, cotton, furs and many other decorative products. The colors have been put out in two grades, designated as steamproof and waterproof. Besides these, certain products for fur dyeing will also shortly be announced by the manufacturers, Malgo Products, Inc., of New York. At present the range of dyes for textiles comprises twelve primary colors which, according to their makers, can be mixed to produce over three thousand different shades.

The Malgo Products corporation is a new firm established by I. Malino and Alfreides Gomes.

AMERICAN
DYESTUFF REPORTER

Devoted to the use and application of dyestuffs and the mechanical equipment incidental thereto.

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WHY NOT SHOW THE PUBLIC?

DYES have not been prominently featured at the last three Expositions of the Chemical Industry. At each successive chemical show, in fact, there seems to have been a decided waning of the interest taken in these expositions by American dyestuff manufacturers. The condition has prompted us on several occasions to express our regret that very little effort is being made to inform the American public of progress in dye manufacture.

Several reasons may be advanced to explain the general indifference of the dye industry toward the Chemical Expositions. Foremost is the fact that in recent years the exhibits of machinery and equipment have dominated the center of the stage, with the inevitable result that chemical products such as dyes have had to be content with what little limelight fell upon them. Again, the smaller dyestuff manufacturers have considered it scarcely worth while, as a business proposition, to display their wares to a public that included only a scattered handful of actual dye consumers.

A co-operative display at the Chemical Exposition, supported by and representing the entire dyestuff industry, has been suggested. The REPORTER heartily indorses the idea. The main purpose of such an exhibit would be to draw the attention of the American public every two years to the achievements of the dye industry. Never should we pass up an opportunity to impress upon the public some striking conception of what our dye manufacturers have accomplished in their interest, as well as what the industry has come to mean in terms of national welfare.

A display of dyestuffs *can* be made impressive. With a little thought and effort we should be able to break away from the conventional type of dyestuff exhibit. At the British Industries Fair last year something decidedly novel was achieved by the Imperial Chemical Industries, Ltd. We quote from a description of this exhibit published in the Manchester Guardian Commercial, which remarked, incidently, that "there is little interest in a bottle of dye, and a dyed fabric tells one very little about the dye."

> The dye-making section of the I. C. I. has made an attempt to show how a dye is made and used. The dyestuff chosen is Acid Orange G, and the onlooker sees a colorless solution of beta naphthol meeting a colorless solution of diazotized sulphanilic acid, to form a colored solution. The separation of the dye is shown, and near by is a model of a dye plant where a piece of silk is being dyed with the color. A chart indicates the sixteen other substances used for the production of the color, and is a further demonstration of the interdependence of the various sections of the I. C. I.

At the forthcoming Exposition of the Chemical Industries, which opens in New York September 26, foreign manufacturers will exhibit for the first time. It is likely foreign dyes will be among the products shown. This year's show, we therefore believe, marks an opportune occasion for the American dyestuff industry to present to the public an effective display of its products. It would add immeasurably to the prestige of domestic-made colors.

THE TEST OF CAPABILITY

"FOLLOW instructions carefully"——

This phrase we have tossed about so lightly that we no longer appreciate the plain sense of it. Because we find it printed on pill-boxes we overlook its application to our daily work. For it is the first test to apply to the man we employ. It is the first test of a capable apprentice; it is also the first test of the finished craftsman.

Some there are who can never learn to follow instructions. They have not the mental capacity to pay attention when instructions are given them. There are those who will not follow instructions. They want to show that they are "original." No matter how a thing should be done, they can do it another way. The mill pays for their originality in damaged goods; and the "original" one's superior—the boss dyer, perhaps, or the chemist—is held responsible. Finally, there is that rare worker who makes the ideal assistant because he knows how to follow instructions to the dot. Later he makes the ideal superintendent because he is dependable.

Few things try the patience of a department head more than a subordinate who cannot or will not follow instructions. Such a man is seldom considered for any position higher than routine worker; he is fortunate if he can hold down that job. Generally, every man around the dyehouse or in the laboratory is given a fair opportunity to show his intelligence and ability. If, from the start, he scrupulously follows his superior's instructions on every assignment, he soon becomes known as one who is

alert and trustworthy. His "chief" depends on him for assistance in important work and is never disturbed by a misgiving that he will not follow directions.

Later, after he has proved his ability to take instructions, the worker may display his originality by doing some routine job a little better or a little more rapidly than it could be done by the old way. Such initiative should not be discouraged; every worker should learn to rely on his own judgment in the ordinary course of his duties as well as in emergencies. But until he knows his work and has earned the confidence of his employers he had better follow instructions. In no other class of work does this dictum hold truer than in chemistry and textile processing, where the slightest deviation from instructions may lead to grave trouble. Nor, in following another's orders, should a man feel that his own "style" is being cramped. He should remember that his superior, although paid for using judgment, is always following some instructions from higher up.

ANSWERING A CORRESPONDENT

THOSE readers who have more than a passing interest in the editorial policies of the REPORTER will find several thought-provoking ideas in the article that follows this editorial, under the title "What Shall We Say and Write?" It will be recalled that the first of these communications from a reader was published a few weeks ago.

The further suggestions of this reader and the timely questions he asks will undoubtedly strike a responsive note in the minds of his fellow contributors. Some of his questions in particular will probably be echoed by all those who have felt an urge to read a paper before meetings of the American Association of Textile Chemists and Colorists, and have repressed that urge merely because they were inexperienced in writing for publication. How many readers who might otherwise contribute to these pages have been perplexed at the start by such details as the length of their paper, or its precise form, or the method of treating the subject, we have no means of knowing. But among the dyehouses and laboratories regularly visited by the REPORTER there may be many more potential writers than we suppose. It is this thought that prompts us to answer now some of the queries put to us in the letter on the opposite page.

As our correspondent states, the A. A. T. C. C. has notified members that papers for presentation at its next annual meeting, to be held in December, should be submitted to the Council before October 1. In setting this rule the object was not to curtail in any way the number of papers that might be offered for delivery but, on the contrary, to make a greater number possible, since in this way the authors of lengthy papers can be requested to present them at the meeting in a somewhat abstracted form. Such papers, it will be understood, would appear in the Proceedings in full. It is also believed that under this method of preliminary inspection the program can be arranged far more satisfactorily than has been the case with former meetings.

Most of the papers delivered at an annual meeting should be of moderate length, occupying from fifteen to twenty minutes of the program and allowing from ten to fifteen minutes for discussion. In rare instances thirty minutes might be given to an important paper, particularly if it were of such character as to call for little, if any, discussion. Any paper requiring more than fifteen or twenty minutes should, as a rule, be presented in a condensed form.

But these references to time-lengths of papers are confusing. Length is measured more easily by pages than by minutes. The following data are therefore furnished to guide those who would present papers before association meetings or write articles for the REPORTER:

It takes from one and one-half to two minutes to read a double-spaced, letter-sized page of typewritten material. In other words, the average paper for presentation at the annual meeting should be from six to ten such pages in length. If a paper exceeds ten pages it should be presented in a somewhat abbreviated form.

Each full page of the REPORTER contains on an average 1,000 words. This figure, of course, will be cut down more or less by section headings, illustrations and tables. From three to three and one-half sheets of ordinary business stationery containing double-spaced typewriting will supply enough text for one full page of the REPORTER.

The most desirable length for ordinary technical articles is from 2,000 to 3,000 words; or, to express it more simply, from two to three pages. Articles exceeding 4,000 words are usually published in two or more parts. Consequently, a long article should, if possible, be so arranged that it may be divided into 2,000 or 3,000 word instalments without interfering with its continuity.

Our correspondent calls for light upon another mechanical detail in connection with the preparation of articles. "How many and what kinds of illustrations are wanted?" he asks. Well, since pictures appeal to everybody, it follows that every illustration adds to the interest of an article; hence, the number of pictures or diagrams can best be determined by the length of the article; the more illustrations, the more readers will the article attract. If photographs are used they should be clear prints, as large as possible, up to 10 or 12 inches square. Drawings, formulas or charts should be made in black India ink on either white paper or tracing paper. These, too, should be large within reasonable limits, and all lettering in them should be neatly drawn. Captions to appear beneath an illustration may be written on the reverse of the drawing, as they are usually set in type.

So much for the mechanics of the matter. These and all similar details relating to the preparation of articles for your journal the editorial staff is able to discuss to the point of boring its readers and with little fear of erring. But what is to be said when our correspondent asks us to define, even in a general way, the kinds of papers that, as he says, "suit the majority"? Many there

surely are who presume to know what they want to read on textile processing. To them these columns are open; but not alone to them, for we welcome from any of our readers communications upon any subject relating to the craft and science to the advancement of which this journal is dedicated. Such communications may be submitted upon a wide variety of topics, ranging all the way from comment on new processes, on irregularities that may occur in old ones, or on unusual and perplexing problems, to plain, matter-of-fact discussion of any of the articles and papers appearing in these pages.

The REPORTER will gladly pay regular editorial rates for any such communications as may be accepted and, if it is so desired, will withhold the author's name.

What Shall We Say and Write?—II

A Communication from a Reader

ALL that was said in the earlier installment with respect to writing is equally applicable to papers that might be presented at association meetings. The requirements are very much the same, with the addition that length, or time required for delivery, may be limited.

It is worthy of note that the papers for the next annual meeting of the American Association of Textile Chemists and Colorists are to be given some preliminary scrutiny as to suitability and length. Since the average inexperienced speaker has little idea how long it will take to present his paper it would seem quite appropriate if some announcement could be made beforehand as to how many minutes should be allowed for the paper proper; or, what would mean more to most of us, how many words or typewritten pages would be appropriate for the time available.

It might also be very helpful if some announcement could be made as to the kind of paper that is considered most desirable, not so much the specific subjects but in more general terms. It is a common hope among the audience that the next speaker will stand up and tell us specifically how to solve our problems, but, of course, that rarely happens. There may, however, be some type of paper that suits the majority better than others.

The writer, speaking now both as listener and reader, feels that one of the most worthy functions of the trade publication and of the association meeting is to promote in every reasonable way the science that applies to textile work, and to some extent to offer a medium for the presentation of the results of scientific research, even though it be rather "pure" in nature, provided it has textile interest.

A type of article that is sometimes frowned upon is the more scientific "high-brow stuff." This may not interest the "practical man," although an understanding of it might do him good. It will, however, be of immediate interest to those engaged in research or any other original experimentation. Progress has been based upon science, and it will continue to be, and science must have a means of expression. For this reason no really pertinent chemical or other research work should be refused, but it should be very definitely encouraged. If the material offered is unsuitable for oral presentation *in toto* we should be willing to be the "goat" for a few minutes and show our appreciation of honest effort to the extent of listening to an abstract, and then allowing publication of the whole, or such an abridgement as appears appropriate to our duly constituted authorities, in the Proceedings.

Couldn't it, and shouldn't it, be made more widely known that we have here an excellent medium for research offerings that are related to one of the very largest industries, and that it is the most suitable medium at hand for much of this material?

Without the intention of detracting in the least from the American Chemical Society, it is a fact that its programs are often seriously overloaded, and that the audience is not always the best adapted to the appreciation of some of the papers presented in the Dye Section, and perhaps occasionally in the Cellulose or some other section. Some of this material might eventually drift our way if it became more widely known that the association and the REPORTER are scientific as well as "practical" institutions. We do not advocate making the REPORTER over into a scientific journal, but it should be recognized not only as being scientifically correct but as having a definite scientific value.

Speaking again of writing, the present writer has often thought that it might be very helpful and encouraging if the editor or publisher would write or in some way sponsor a good article on how to write. Why not tell how many typed pages make one REPORTER page, how much is preferable for a single article or installment, how many words desired in the title, how many and what kinds of illustrations are wanted, how to draw charts so that they will reproduce best, and how to handle any other details that sometimes puzzle an author, whether new or old?

Now, coming to the reader's part, the editor is like any other kind of a broadcaster. He needs the opinions of the audience if he is to best serve that audience. Certainly one of the best ways of making a good publication better is to express an opinion now and then, and a still better way is to make a contribution to its pages, following, possibly, some of the suggestions that have already been made.

LARGE DYEING PLANT FOR GREENVILLE

A two-million-dollar dyeing and finishing plant will be erected at Travellers' Rest, Greenville, S. C., according to an announcement from the Greenville Chamber of Commerce. The firm constructing the plant is said by J. E. Sirrine & Co., the architects, to be a large Eastern company.

The new plant will be about six miles from the Slater plant at Marietta. It will be operated principally for dyeing and finishing, though it is mentioned that spinning and weaving departments may later be added.

RECENT LITERATURE

The Dyeing of Textile Fibers. By R. S. Horsfall, M.Sc., and L. G. Lawrie, A.I.C. 414 pages. Price $9.00. D. Van Nostrand Company.

Books published on dyeing or any other highly technical subject fall into two distinct groups: they are either of the textbook type, for students of the subject, or highly scientific treatises, for the erudite technologist. "The Dyeing of Textile Fibers" is of the first class. It will not interest the scientifically trained expert. But for the student it will serve as an authoritative and very readable general introduction to the whole subject of dyeing textiles. It is like a well-drawn relief map of a vast area: extremely valuable to one who knows little of the country or only one section of it, but rather elementary for the experienced "native guides."

The book, it must be said, begins at the beginning—with an interesting historical survey of dyeing and dyestuffs, and some general observations on light and color, on color measurement and blending, and on the dyeing process. It possesses one notable merit: it is, on the whole, up to date. If it delves into past theories, methods and processes, it also deals adequately with the most modern knowledge on the subject. The dyeing process for each class of fiber is treated from the angle of the material to be dyed, rather than from that of the dyes and chemicals used. But dyestuffs are not neglected. Each class of colors is discussed in connection with the textiles on which they can be applied. Descriptions of the newest series of colors are included in such discussions. One section of considerable length is devoted to a description of the Naphthol colors, for instance, and another section to the Indigosols and the Soledons. A full chapter is given over to rayon, its dyeing and its dyes. There is an interesting chapter on the chemicals used in the dyehouse.

The final sections of the book contain sundry tables of weights and measures useful in dyeing practice and six pages of bibliography, arranged by subjects.

The text in some places has been condensed a little more than a book of this type requires. To take specific instances, the effects of acids on wool are dealt with in two short paragraphs and the aftertreatment of dyed cotton is discussed in but one paragraph. But these are exceptions, and despite this defect the book will be of very practical value to all who would cover the subject of dyeing in a general survey before studying any of its special branches.

Annual Proceedings of the Cotton Manufacturers' Association of North Carolina.

Contains the addresses, reports and discussions of the association's twenty-first annual convention, held in June. Some of the addresses on economic and social conditions in the South and on the development of North Carolina's cotton industry make interesting reading, for they afford an informative survey of present conditions in the American cotton industry as seen in relation to past development. Southern Mills Rules for 1925 are included in the latter part of the book.

A Survey of World Chemical Trade

The Chemical Industry—Documentation of the International Economic Conference. Publication of the League of Nations. World Peace Foundation, Boston, Mass. (American Agent). 134 pages. $1.00.

The chemical industry came into its own years ago as an essential national enterprise in every major nation of the world. Any doubt of its position in the economic system of nations was entirely dispelled when the industry was slated for discussion at the International Economic Conference held in Geneva last May.

Germany was appointed to submit a survey of the chemical trade and industry of the world. Great Britain was permitted to comment on the German document, and offered observations of her own. France sent in a survey from the French viewpoint. Italy and Poland drew up monographs on their own chemical industries. All of these documents are included in this League of Nations publication.

Chemical and dyestuff executives who like to keep informed on the world-wide activities of their industry will want to have this book for reference for its analysis of chemical production, tariffs, exports and imports, labor conditions and marketing surveys, for its fund of information and its statistics. More interesting than anything else is Germany's attitude toward the competition in dyes and chemicals which, since the war, has choked off her monopoly, and also Sir Arthur Balfour's comments on the Germany survey.

FASTNESS RESEARCH IN ENGLAND

At the laboratories of the British Research Association for the Woolen and Worsted Industries, at Headingly, England, extensive tests have been made on the fastness of dyed wool. The first object of these tests, according to a report in the Textile Argus of the association's activities, was to determine the standard conditions for fading, and the investigators arranged to co-operate with experimental stations at home and abroad—many of them in tropical countries—where patterns of worsted cloth in various colors were exposed to sunlight. It was discovered that there was actually less fading under the burning sun of Southern countries than in England.

The dyeing and cleaning industry of Havana, Cuba, imports from the United States quantities of coal tar distillates. Total imports of coal tar products into Cuba during 1926 were valued at $26,800, according to the Department of Commerce.

RECENT PATENTS

Process of and Apparatus for Treating Fiber

(1,632,802; June 21, 1927)

George A. Richter, of Berlin, N. H., assignor to the Brown Company, of Berlin, N. H., a corporation of Maine.

This invention relates to a process of treating fiber with a chemical solution, and has for its object to provide a process of treating such fiber in a continuous, efficient and economical manner.

After fiber has been liberated by suitable digestion from wood chips or other cellulose-bearing material, it is frequently desired further to treat such fiber with a chemical solution. For example, it may be desired to treat raw sulphite fiber with a solution of caustic soda to effect a removal of the non-alpha cellulose constituent present therein and thus to produce a fiber containing a high percentage of alpha or resistant cellulose.

If such alkaline treatment is carried out under the proper conditions for the requisite period of time, the resultant fiber will contain upward of 93 per cent alpha cellulose, and is bleachable to a high degree of whiteness with a low strength bleach solution. Such "alpha" or purified cellulose fiber is suitable for use as a new rag or cotton fiber substitute in the manufacture of high grade papers and the preparation of cellulose derivatives. In commercial practice, the chemical present in the spent treating liquor is recovered.

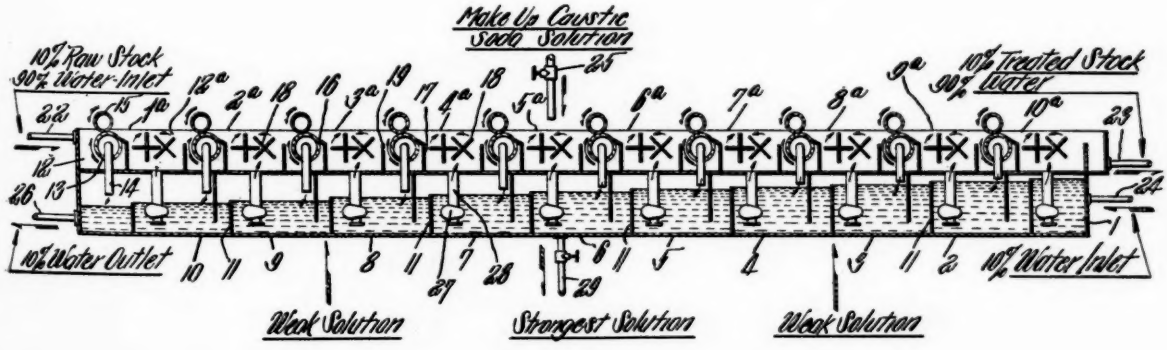
One feature of the process of the present invention is that the chemical present in the spent liquor may be recovered without requiring high concentration of raw fiber, thus eliminating the necessity of a high pressure thickener or the like. Another feature is that the fiber is washed free from treating chemicals simultaneously with the treatment. Still another feature is that fiber stocks of different water contents may be subjected to treatment. This alkaline or other chemical treatment may be carried out at an elevated temperature, and the heat and chemical content of the spent liquor conserved.

In accordance with the process of the present invention, the chemical treatment of the fiber takes place while such fiber is being passed through and washed in continuous, counter-current flow. This may be done in apparatus of the general type shown and described in United States Letters Patent No. 1,421,664, issued July 4, 1922, to Brown, Moore, Parker and Martinson. A series of treating baths gradually increasing in concentration of treating chemical from substantially only water at one end of the apparatus to a solution of maximum chemical concentration at an intermediate portion thereof and then gradually decreasing in concentration from the intermediate portion to substantially only water at the other end thereof, is maintained in the apparatus. Water is continuously introduced into one end of the apparatus, and a flow of solution is produced from bath to bath toward the other end of the apparatus, from which water is discharged, and into which fiber to be treated is continuously passed through the apparatus in countercurrent flow to the water. A volume of spent solution containing the chemical being spent is continuously withdrawn and sufficient fresh chemical solution to make up mechanical losses and to replace chemical in the solution being withdrawn is continuousely introduced into the intermediate portion of the apparatus.

Fig. 1 represents somewhat diagrammatically and conventionally a section through an apparatus for carrying out the process.

The apparatus comprises a series of sections, each consisting of a storage tank containing a pool of treating solution, and a treating tank associated therewith and located thereabove. The treating solution in the successive storage tank flows in a direction opposite to the flow of the fiber. These tanks are indicated as 1, 2, 3, 4, 5, 6, 7, 8, 9 and 10, in the direction of solution flow. The solution overflows a series of partitions 11 placed between the tanks and gradually decreasing in height from the tank 1 to the tank 10 so that a substantially continuous flow of solution from the tank 1 to the tank 10 results.

The treating tanks are designated as 1a, 2a, 3a, 4a, 5a, 6a, 7a, 8a, 9a and 10a, in the direction of the flow of fiber. Each treating tank is divided into two compartments. First there is a thickening compartment 12, in which rotates a straining cylinder 13, on which the fiber



is deposited and through which the treating solution passes and is returned by a pipe 14 to the corresponding storage tank. The fiber deposited on the straining cylinder is squeezed and thickened by a couch roll 15 acting on the cylinder. The fiber is removed from the cylinder and deposited in an agitating compartment 12a containing the treating solution, by a scraper 16 acting against the cylinder and stationed on a partition 17 dividing the thickening and agitating compartments. A supply of solution is maintained in each treating tank by withdrawing solution from the corresponding storage tank by a pump 27 and delivering it through a pipe 28 into the agitating compartment. The fiber is agitated in the solution maintained in the treating compartment, by a pair of agitators 18, and flows over a partition 19 into the next adjacent thickening compartment. There is thus a constant circulation of the treating solution from each storage tank, through the agitating compartment of the treating tank, and thence through the straining cylinder back to its storage tank.

Treatment with Caustic

Where a raw fiber, e. g., unbleached sulphite, is to be purified into fiber of high alpha cellulose content, the treating solution may be a solution of caustic soda or equivalent compound. The raw fiber may be delivered into the apparatus, as it comes from the washing and screening operations, as, say, a 10 per cent to 12 per cent aqueous pulp suspension. As it passes through the successive treating tanks toward the center of the apparatus, the water associated therewith is displaced by a caustic soda solution of increasing strength, so that it acquires a maximum caustic soda concentration when it reaches the treating tank 5a into which the caustic soda solution is introduced. On passing forwardly from the tank 5a, the caustic soda solution associated with the fiber is displaced by a solution of progressively decreasing strength, so that when the fiber is discharged from the last treating tank 10a, the solution is substantially entirely displaced by water.

Operation may be initially commenced by maintaining the volume of caustic soda solution continuously delivered into the treating tank 5a, and the volume of wash water continuously introduced into the storage tank 1 substantially equal to the volume of water associated with the raw fiber. The apparatus is controlled to discharge a fiber having a water content equal to that of the raw fiber. Substantially only water is discharged through the outlet pipe 26. After the equilibrium concentration of caustic soda has been attained in the tanks, only sufficient caustic soda solution to make up sodium constituent spent and contained in spent solution bled off from the storage tank 5 through a valved pipe 29 and to make up mechanical losses, need be introduced into the treating tank 5a. The volume of wash water introduced into the storage tank 1 is then maintained substantially equal to the water content of the raw fiber as it is introduced and the water discharged through the outlet pipe 26 so that the concentration of active or unspent caustic soda in each of the storage and treating tanks remains substantially constant during the continuous operation of the apparatus. The flow bled off through the pipe 29 is regulated to provide for the withdrawal of the solution, the sodium constituent of which has been spent by reaction with the non-alpha cellulose constituent of the fiber so that accumulation of dissolved organic matter in the apparatus is prevented. Of course, some unspent sodium constituent is necessarily drawn off, also. This bleed solution may be concentrated, incinerated and smelted, as usual, for the recovery of the sodium constituent.

Displacement of the Solution

The process may be considered as comprising two steps, during both of which a dissolving and removal of the non-alpha cellulose constituent of the raw fiber by the caustic soda solution is effected. First, the displacement of the water content of the raw fiber by a solution of caustic soda occurs and then the displacement of the solution of caustic soda by water. Consequently, substantially all the treating solution except that drawn off through the pipe 29 is maintained within the apparatus,—substantially only water accompanying the purified fiber discharged through the pipe 23 at one end of the apparatus, and substantially only water being discharged through the outlet pipe 26 at the opposite end thereof. If the treatment is carried out at an elevated temperature as by introducing steam into the central pool maintained in the storage tank 6, the heat content (except for that of the bleed solution), in addition to the chemical content of the solution, is maintained within the apparatus.

When a concentrated solution of caustic soda is employed in treating the fiber, only a relatively short treating period, say, five to ten minutes, at about room temperature, is necessary to produce an alpha fiber having characteristics rendering it especially applicable for viscose preparation.

When a relatively dilute solution of caustic soda is employed in treating the fiber, a longer treating period and and an elevated temperature are necessary to produce fiber of the desired alpha cellulose content. The time of treatment may be prolonged by operating the apparatus at lower capacity or by constructing one or more of the intermediate storage and corresponding treating tanks of the apparatus longer than the others.

It is evident that, if desired, a certain amount of bleach liquor or other equivalent oxidizing liquor may be introduced with the caustic soda solution into the tank 5a to aid in the purification of the fiber.

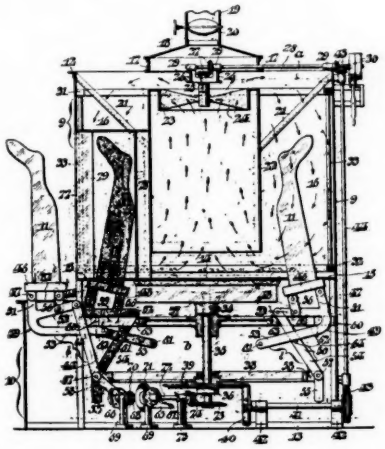
While the process of the present invention has been described in connection with treatment of raw fiber to purify the same, it is obvious that this is illustrative only, and that the process may be practised to effect a treatment of fiber with other chemical solutions.

Hosiery-Drying Machine

(1,634,237; June 28, 1927)

Walter W. Sibson, Philadelphia, Pa., assignor to the Philadelphia Drying Machinery Company.

In a drying machine having a zone open to the atmosphere, superposed spiders conveying forms therethrough in relative stationary disposition, and means



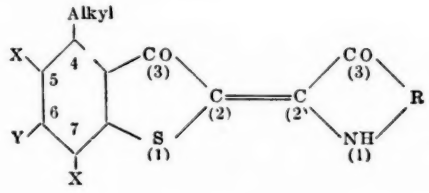
functional to radially rock successive forms outward and inward with respect to the drying zone for stripping and reclothing.

Violet Vat Dyestuff of the 2-Thionaphthene-2-Indolindigo Series

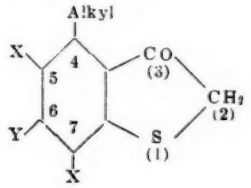
(1,631,865; June 7, 1927)

Richard Herz, Frankfort-on-the-Main, Germany, assignor to Grasselli Dyestuff Corporation, New York, N. Y.

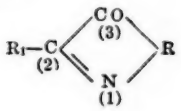
As new compounds violet vat dyestuffs of the 2-thionaphthene-2-indolindigo series corresponding probably to the general formula:



wherein X means a halogen or an alkyl group, Y means hydrogen, which may be substituted by a halogen or an alkyl group and R means an aryl residue which may contain further substituents, which dyestuffs are, when dry, violet powders, soluble in concentrated sulphuric acid to a greenish to blue solution, forming with alkaline hydrosulphite a yellowish vat, from which cotton and wool are dyed in violet to bluish-violet shades of an excellent fastness especially to washing, chlorine and light, which dyestuffs are substantially identical with the dyestuffs, obtainable by condensing oxythionaphthene derivatives, corresponding probably to the general formula:



wherein X means a halogen or an alkyl group, Y means hydrogen which may be substituted by a halogen or an alkyl group, with an α-isation body of the general formula:



wherein R means an aryl residue, which may contain further substituents, R_1 means a halogen or an arylido group.

Anthraquinone Paste, and Method of Making the Same

(1,631,589; June 7, 1927)

William M. Grosvenor and Victor P. Gershon, New York, N. Y.

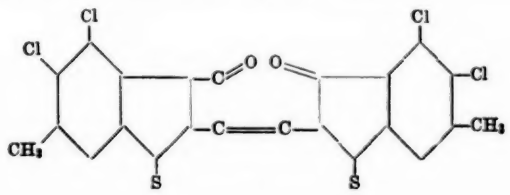
The improved anthraquinone paste, comprising a mixture of sublimed anthraquinone and water, and capable of holding about 80 per cent of water without substantial separation thereof on standing.

Thioindigo Vat Dyestuffs, and Process of Making Same

(1,632,252; June 28, 1927)

Karl Thiess, Carl Josef Muller and Ernst Runne, Hochst-on-the-Main, and Albert Schaeffer, Maxheim-on-the-Taunus, Germany, assignors to Grasselli Dyestuff Corporation, New York, N. Y.

As a new product, the herein described thioindigo vat dyestuff of the following constitution:



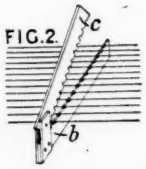
The Columbia Mills, Minetto, N. Y., will take bids about the middle of September for a new one and three story mill at West Pullman, Ill., to cost about $40,000, for which plans are being drawn by Lockwood, Greene & Co., Boston, Mass., architects and engineers.

Technical Notes from Foreign Sources

Finishing and Mercerizing Textile Materials

In the mercerization, ornamentation and finishing treatment of textile materials (yarns and fabric) containing cellulose, producing effects varying from a lustrous, soft, elastic finish to a transparent smooth and stiffer material, according to the extent or duration of the treatment, a mercerizing, cellulose gelatinizing agent is used. The basis of this agent is an 8 to 18 per cent alkaline lye, and the material treated therewith is then treated with a 2 to 10 per cent solution of ammonia or equivalent ammonia generating ingredients, or urea or other carbonic acid-ammonia derivatives. Then it is brushed, mangled, or scraped to 1½ to 2 times its original weight, with or without cooling to minus 7 degrees C to minus 15 degrees C and submitted without drying to a scouring action with acid, then washed and dried.

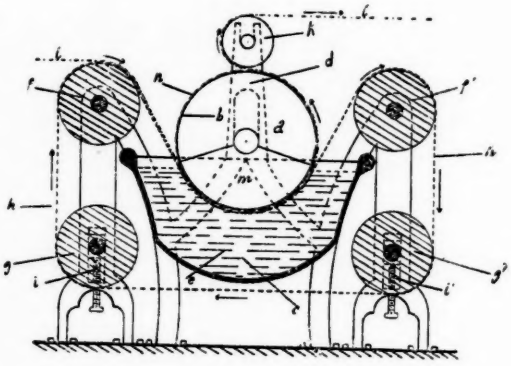
The treatment may be local, producing brocade or damask effects, or it may be applied to the whole surface, and curling or crepe effects may be obtained by allowing shrinking during the final drying or by varying the tensioning in the direction of the warp and the weft.



The mercerizing liquid may contain in solution up to 5 per cent of cellulose materials, such as one or more of the following: cellulose, protein, or plant pith. Natural silk, agar-agar, and the like in solution may also be added. In using urea, thiourea, guanidine or the like, or they may be used subsequently. The local treatment for the production of patterned effects may also be by printing, stenciling or the like, and either white or colored resists may be used. Grooved upper and lower scraping devices, shown at b and c in the figure, hinged together, or the top member c in two parts hinged one at each end of the lower member may be used to remove the excess liquor where yarns are treated. (British Patent No. 266,466.)

Dyeing Fabrics in Designs

According to German Patent No. 435,394, fabrics are dyed in designs with the aid of a stencil, which consists of a gauze-like fabric covered with wax. The wax covering is provided with cracks just like marble, through which the dye liquor or the discharge preparation can be sucked through and into the fabric that is to be dyed. The figure shows the apparatus employed for this purpose. The stencil h, which is provided with a coating and openings through which the dye liquor penetrates, is led as an endless band over the guide rollers f and f', g and g' and under the suction drum a, in whose lower third a suction arrangement m is placed. The suction drum dips into a vat c, in which the dye liquor or the discharge preparation e is found. The tension on the stencil h is regulated by means of threaded screws i and i'



which act on the guide rollers. The fabric that is to be dyed in design, shown at l, runs along with the stencil h from the guide roller f through the color bath e, and is led further around the perforated jacket d of the suction drum a, and finally over the drying cylinder k.

Due to the fact that the fabric l is protected from coming into contact in any way with the dye liquor c and may be said to be tightly isolated from it, the only dyeing that takes place on the fabric is through the openings in the stencil and the result then is that the designs are reproduced on the fabric in a cleancut manner. The process can be carried out on all sorts of fabrics, such as knitted wear, tricots and the like, and these fabrics are then dyed in the batik manner. In order to obtain variations in color tones in the design, shadings and the like, a second water-tight stencil covered with the gauze stencil as well is placed around the covering b of the suction drum a. This makes it possible to obtain all sorts of variations in shade. The water-tight design stencil is made either of waterproofed paper or from a waterproofed, impregnated fabric.

Bleaching Cotton

The process, which is patented in French Patent No. 592,536, allows the impregnation and rapid bleaching of vegetable fibers, yarns or fabrics, by treatment in a cold bath containing soluble oils or soaps, either alone or admixed with hydrocarbons, or containing resinates or compounds resulting from the action of a salt of a fatty acid on a resinate.

The rosin soaps become soluble in cold solutions when they are made to react with ricinoleates or sulphoricinoleates. For example, 100 kilograms of rosin, 39 kilograms of calcined sodium carbonate are made up into solution with 200 liters of water. The solution is brought up to the boiling point and while the solution is still boiling the following preparation is added after saponification. This preparation consists of 139 kilograms of castor oil, 67.5 kilograms of sodium hydroxide solution of 40 degrees Be and 200 liters of water. The mixture of the two preparations is stirred well and in the cold amounts to 650 kilograms.

After the raw fabric has been passed through this bath, it is immediately washed. This washing permits the immediate elimination of the principal impurities, the amylaceous products, starches, etc., with the necessity of using hydrolytic methods.

The material is then ready for bleaching which is carried out in a bath of alkali hypochlorite containing from 0.4 to 0.5 per cent of active chlorine, and the bleaching is then finished by passing the fabric or yarn through a solution of sodium bisulphite.

Improved Permanganate Bleach for Cotton

The bleaching of wool or silk with permanganate can be carried out without any serious difficulties. On the other hand the treatment of vegetable fibers with this chemical is not so easy a matter, principally due to the difficulty of precipitating sufficient quantities of manganese hydrate on the fibers.

The quality of the white that is obtained with permanganate bleach on cotton is not very good, particularly on Egyptian cotton. Better results are obtained with the aid of the improved method which is described below.

Egyptian cotton in hanks was previously well boiled-out and washed and then impregnated with a cold solution of sodium hydroxide, 8 to 10 per cent on the weight of the cotton being used, and allowed to remain over night. Then the cotton is taken out of the liquor and washed twice in the cold and then soured with the aid of sulphuric acid solution, 2 per cent being used on the weight of the cotton. If the water contains lime salts, then the souring treatment is carried out with 1.5 per cent of sulphuric acid and 0.8 per cent of hydrochloric acid.

The material is then washed and treated with a solution of 4 per cent potassium permanganate and 10 per cent of strong hydrochloric acid. The hydrochloric acid causes slow reduction of the permanganate and the subsequent fixation of the manganese hydrate—about 3 per cent—on the cotton fibers. After 5 to 7 passages through this bath, the yarn is removed and another 3 per cent of permanganate is added, the yarn being again introduced into the liquor and then worked around seven times in it. More acid is not added. The liquor is not exhausted and can therefore be preserved.

The material is washed (once is sufficient) and thereafter treated with a solution of 5.5 per cent of sodium bisulphite and 15 per cent strong hydrochloric acid. The cotton is again washed and again introduced into the permanganate bleach liquor to which 5 per cent of denatured alcohol has been added. The reduction of the permanganate takes place now at a much greater speed and the precipitate of hydroxide on the fiber reaches approximately 15 per cent due to the presence of the alcohol in the liquor. The material is then again entered into the sulphite liquor and a perfect white is thus obtained. It is well washed in the first water to which a little acid has been added, in order to remove any manganese salts, likewise traces of sulphuric acid. The innovation in this process is the use of hydrochloric acid and alcohol.

The hydrochloric acid is used in such amounts that the decomposition of the permanganate takes place on the fiber itself and no precipitate occurs in the solution. The use of too much hydrochloric acid would result in the formation of nascent chlorine and permanganic acid, which would destroy the fiber.

When chlorine is set free in small amounts, then it first acts as a reducing agent, before it exerts an oxidizing action on the fiber, and it is for this reason that hydrochloric acid is preferred.

Alcohol plays the role of a reducing agent in the presence of acid, as it is itself oxidized to aldehyde and then completely to carbon dioxide and water. This is a reaction which serves to moderate the oxidizing action of the permanganate.

It is easy to see that other products will also give the same results, such as formaldehyde, but in this case the reaction is not so regular, and for this reason denatured alcohol is used to better advantage.

The white obtained in this manner on cotton is relatively fast. A trace of chlorine remains in the material, just as it remains behind the bleaching process, as carried out with the aid of calcium or sodium hypochlorite.

The goods are much more uniformly bleached and hence can be more uniformly shaded or dyed. The bleaching operation requires two hours for 100 kilograms of yarn. The process is particularly interesting for bleaching the fiber on spools, cops and the like. (The Textile Recorder, through Deutsche Faerber Zeitung, 1927, p 371.)

Loss of Weight of Cotton in Bucking

Data have been published on the loss in weight suffered by cotton in the bleaching operation. The boiling-out process serves first for the removal of the oily, fatty and waxy impurities in the cotton. Many, and perhaps most results of investigations can make but little claim for accuracy, for the effect of the changeable moisture content in weighing the samples was not taken into consideration. This is an important matter.

As is known, variations in the duration of the boiling, in the pressure in the kier and in the concentration of the liquor cause differences in the proportion of the wax removed as in the total loss. Interesting results have

been recently published by the British Cotton Research Association. These contain the losses incurred in different treatments of the cotton and afford an accurate idea on the losses to be expected in practical operations.

The results were obtained in a small kier but were calculated on large scale operation basis. Some of the results obtained are given in the following tabulation:

	Loss in Weight	Wax Remaining
Boiling with 1 per cent sodium hydroxide solution for six hours at—		
112 deg. Fahr.	4.1%	0.49%
212 deg. Fahr. (boiling point)	5.2	0.36
241 deg. Fahr. or 10 lb. pressure	6.7	0.21
257 deg. Fahr. or 20 lb. pressure	7.0	0.20
273 deg. Fahr. or 30 lb. pressure	7.2	0.18
286 deg. Fahr. or 40 lb. pressure	7.1	0.17
Boiling in a 1 per cent liquor, as above and at 20 pounds pressure for—		
Two hours	6.6	0.30
Four hours	6.7	0.22
Six hours	7.0	0.20
Twelve hours	7.1	0.23
Boiling in an open kier at 212 deg. Fahr. with—		
1 per cent sodium hydroxide	5.2	0.36
2 per cent sodium hydroxide	6.3	0.26
3 per cent sodium hydroxide	6.4	0.19
Boiling as above at 20 pounds pressure with—		
0.5 per cent sodium hydroxide solution	6.7	0.20
1 per cent sodium hydroxide solution	7.0	0.20
2 per cent sodium hydroxide solution	7.0	0.28
3 per cent sodium hydroxide solution	7.3	0.24
Boiling for six hours as above but under 40 pounds pressure with—		
1 per cent sodium hydroxide solution	7.1	0.17
3 per cent sodium hydroxide solution	8.1	0.32

Lustrous and Dull Effects in Printing Viscose

The process develops both lustrous and dull effects in the printing of viscose rayon without the necessity of first desulphurizing the fiber. The process depends on the use of sulphites and is carried out in such a manner that sulphite containing printing pastes is employed, which results in the absorption of the sulphur contained in the viscose rayon. Thus the sulphur cannot exert its action during the printing process. It is possible to use not only alkali sulphites but ammonium sulphite and calcium sulphite as well.

After the viscose fabric has been printed, it is dried, steamed and washed. Naturally, colored printing pastes can also be employed in this process and in a similar manner discharge pastes which contain, for example, Formosol, as the discharge can be used to obtain colored designs on dyed viscose fabrics. Substantive as well as basic and vat colors are used for obtaining the colored effects.

The printing paste that is employed in this process may have the following composition, for example: 1½ kg. of Benzopurpurine, 10 kg. of glycerine, 1½ kg. of sodium phosphate dissolved in a little water and 10 kg. of sodium sulphite with the addition of the required amount of British gum. After the fabric is printed, it is steamed, washed and dried.

When basic dyestuffs are employed, the goods must first be mordanted with the aid of a 5 per cent solution of tannin. The printing is then effected with the aid of a paste which contains 2 kg. of Acridin Orange RS, 28 kg. of water, 60 kg. of British gum and 10 kg. of sodium sulphite.

The goods are steamed for a period of one hour approximately, then fixed by treatment with a 25 per cent solution of tartar emetic, washed, soaped and dried. The use of vat colors is indicated in the following example:

The mixture contains 15 kg. of Indanthrene Orange, 10 kg. of sodium sulphite, 4 kg. of glycerine, 3 kg. of caustic soda 76 deg. Tw. concentration and 5 kg. of soda, 2½ kg. of sodium benzylsulphanilate and 4 kg. of Formosol to which the required amount of British gum has been added. (Dyer and Calico Printer, through Der Textilchemiker und Colorist, 1927, page 91.)

Testing Wetting-Out Agents

The properties of various wetting-out agents are described and the necessity for developing a method which can be used as a standard in determining the efficacy of these preparations. Certain fundamental conceptions are developed which the author feels must be fulfilled by any method that hopes to be considered as standard for this purpose.

Thus, with products that are made with an oil base only, solutions of the same fatty matter content should be employed. The same holds good for products which are prepared on an oil base, and which, moreover, also contain a fat solvent. In the case of wetting-out agents not made with an oil base, the standard solution can be made with a concentration of 4 grams per liter.

The temperature of the wetting-out liquor must be accurately determined and the test must be made once at a temperature of 15 deg. Cent. and a second time at a temperature of 80 deg. Cent.

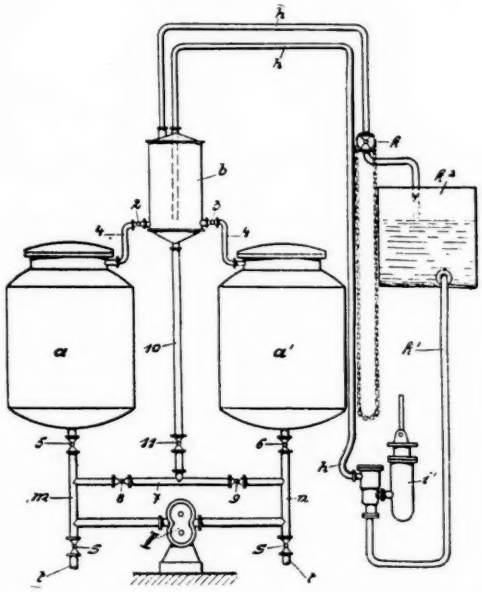
The solutions of the preparations that must be investigated are made once with the aid of distilled water and a second time with the aid of ordinary tap water of a definite degree of hardness, these tests being made at each of the aforementioned temperatures. Furthermore, the testing of the wetting powers of these preparations is effected under like conditions in alkali and acid liquors, while the alkalinity or the acidity of the liquors is maintained at a definite point.

Cotton skeins or wool skeins or woolen fabric of definite length or definite surface area are used as test sam-

ples. In using samples of fabric it must be pointed out that circular samples easily warp and four-sided samples distort in shape. (Melliand's Textilberichte, 1927, pages 349-353.)

Bleaching Textiles with Oxygen or Ozone Liquors

The apparatus shown in the accompanying illustration is patented in German Patent No. 441,269 and is employed to bleach textile materials with the aid of oxygen-containing or ozone-containing liquors. The two bleaching kiers are shown at a and a', which are both connected with the pressure tank b located above the kiers. The pressure tank is connected with the kiers by means of the pipes 4, which are controlled by the valves 2 and 3. The pressure tank b is connected by means of the vertical pipe h with the pressure pump of the compressor C', which sucks out liquor under pressure; for example, reserve liquor from the container k^2 through the connection k'.



Excess pressure is relieved through the super-pressure connection h' and the regulating valve k in the container k^2. The circulating pump is shown at I and the bleaching kiers are connected with this pump at their lower ends by means of the pipe lines m and n. The suction connections are made in these lines at their lower ends, and these connections are controlled by means of the valves s. The suction connections lead to the tanks that contain the bleach liquor, and hence the circulating pump may thus be used both to fill the bleach kiers with the bleach liquor and to empty them as well.

The interconnecting line 7 is inserted between the pipes m and n, and in this branch line the valves 8 and 9 are located for control purposes. An equalizing pipe is inserted between the two valves, and this pipe opens out in the bottom of the pressure tank b and is regulated by means of the valve 11. The pressure connection h of the compressor i' is led into the pressure tank up to the point where the circulating bleach liquor runs off, so that a quick admixture of additional liquor may be made with that already used.

The important and novel feature of the installation is that the pressure tank b, which is connected to the pressure pump i' and the pressure relief pipe h', may be inserted into the cycle by means of the connecting pipe 7; that is, into the entire circulatory system through both kiers, as well as in the circulatory system of each individual kier.

The manner of operating the apparatus is as follows: After the bleaching kiers a and a' are filled with the textile materials, the bleach liquor is filled into the kiers from the liquor tanks by means of the circulatory pump I and the liquor is pumped into the kiers until the desired pressure is obtained therein with the help of the regulating valve k. Then the pump is set to work circulating the liquor by closing the valves but leaving the valves 2, 3, 5 and 6 open. The liquor then flows, for example, through the kier a from bottom to top, through the kier a' in the reverse direction from top to bottom. Hence, in one kier the goods are pressed down, while in the other they are loosened up.

The flow of the liquor is therefore reduced more and more. Hence, an equalization effect must be produced by opening to a greater or lesser degree the valves 9 and 10 in the equalizing pipe. The circulation is also reversed from time to time in order to increase the uniformity of the treatment, and this is done by closing valve 9 and opening valve 8. It is also possible to operate with one kier only if the circulating pipe of the second kier is shut off by opening either valve 8 or valve 9.

Rate of Oxycellulose Formation in Cotton

Measurements have been made of the rate of consumption of oxygen and of the change in the properties of the material when bleached cotton is treated with buffered solutions of hypochlorite, of constant active chlorine content but of varying acidity or alkalinity. Within the range pHS to 10, characteristic of technical bleach liquors, the rate of attack depends on the acidity or alkalinity to an extent which accounts for the differences encountered in practice which were difficult to explain. It is greatest at the neutral point, but slightly acid solutions are very susceptible to catalytic influences which increase their activity.

For example, the traces of chromium which are left in cotton after treatment with dichromate greatly enhance the damage by acid hypochlorite. Alkaline hypobromite solutions are more active than equivalent hypochlorites. Dichromate is a much more active substance in the presence of oxalic acid than when an equivalent of sulphuric acid is present. No case has been observed in which slight modification of cotton by one agent rendered it more susceptible to attack by other means. (Journal of the Textile Institute, 1927, Vol. 18, pages 135-167T.)

THE BRITISH MOVE FORWARD IN TEXTILE RESEARCH

The textile industry of Great Britain has never been accused of neglecting research. English technologists have earned the admiration of the technical world for their untiring industry. They have carried out many notable investigations in the various mechanical and chemical operations of textile manufacture. Some of the results of this research are outlined in a pamphlet entitled "Co-operative Industrial Research," recently published, which gives an account of the research associations established under the plan of the Government Department of Scientific and Industrial Research.

Several textile associations representing the English silk, cotton and woolen trades have planned and pursued studies relating to their respective industries. We take the liberty of quoting from a review of the aforementioned pamphlet that appeared in the Journal of the Society of Dyers and Colorists:

"The Cotton Industry Research Association has so planned its investigations as to cover most of the technical operations of the industry, and the investigations have led to very significant improvement in existing processes. These range from prevention of mildew to standards of "regain," and include machinery and processes of steeping, scouring, bleaching, and dyeing. It is now possible to ascertain the extent to which cotton has been attacked by the chemicals used in these and the subsequent finishing processes, and to define the limits to which the various treatments may be carried without undue deterioration of the material, so that accurate control, particularly of bleaching, is now a possibility.

"The work of the Woolen and Worsted Research Association has related largely to the avoidance of defects in woolen and worsted goods, and to improvements in the technical processes. It is stated that some members have already saved many times the amount of their subscriptions and, in particular, £2,000 per annum for one firm is quoted with respect to the modification of a wool-scouring process.

"At the inauguration of the Linen Research Association the shortage of flax, due to stoppage of supplies from Russia, was a most serious difficulty in the industry, and British flax growers, encouraged at home as a consequence, has now been successful in establishing a pure strain of flax seed, which gives an increased yield of fiber amounting to 25 per cent. The long and complicated process of linen bleaching and also finishing processes, such as mercerizing and dyeing, have all been supplied with data leading to much greater efficiency in the control of these operations.

"The Silk Research Association has worked towards definite standards of fastness towards light, washing etc., of the dyes used; standards have been drawn up and should facilitate the avoidance of disputes.

"As a result of the Laundry Research Association's efforts, at least 50 laundries have installed water-softening plants for which a modest computation assesses a saving of at least £4,000 a year. In addition, special attention has been directed to extending the life of the materials laundered, and if only 5 per cent has been gained, customers should have benefited collectively to the extent of about £100,000 annually."

FURTHER NOTES ON THE CHEMICAL EXPOSITION

"One of the greatest sources of difficulty between nations in the past has been the urge of some one nation to possess land because the land contained a specific raw material and that specific raw material was absolutely necessary to supply some need of the world. The farther the chemist progresses in his work the more fully will this source of friction be removed." So prophesied Dr. John Teeple in an article in The Indicator. Announcements of the features of the 1927 Exposition of the Chemical Industry, to be held during the last week in September at the Grand Central Palace, New York, point out that most of the important synthetic materials created by the chemist will be displayed in one form or another at this year's show.

The United States Government will have two interesting exhibits. The National Safety Council will present the results of its study of benzol poisoning.

The Student Course in Chemistry to be given during the week of the exposition will comprise a number of important lectures, among which the following stand out as being of general interest to chemists: "The Organizations of Chemists and Chemical Engineers," by T. B. Wagner, president of the Chemists Club; "Ethics and Ideals of the Chemical Profession," by Arthur D. Little; "What the Chemist and Engineer Read," by H. C. Parmelee; "Industrial Research," by F. C. Whitmore, Chairman of the Chemical Division, National Research Council; "How the Products the Chemist Makes Are Sold," by Williams Haynes; "What the Chemist and Engineer Write," by H. E. Howe, editor, Industrial and Engineering Chemistry; "Safety in the Laboratory and Plant," by G. Edwin White.

Publication in book form of all the lectures delivered during the Student Course, after the exposition, is contemplated.

Connection with American producers of coal tar is desired by a broker in Paris. It is stated that fifty thousand tons are desired for delivery in France from December, 1927 to June, 1928, on prices on the basis of c. i. f. channel ports, preferably Havre. The name of this broker is available on application to the Chemical Division of the Department of Commerce, from which the information was received.

GERMANY LEADS WORLD IN CHEMICAL EXPORTS

Germany's foreign trade in chemicals is far above that of all other countries, according to a study of the situation made by the Chemical Division of the United States Department of Commerce, the results of which were announced in a recent report issued by the division.

The exports of chemical products from Germany in 1926, according to this report, aggregated 50 per cent more than those of the United States, the total being approximately $256,000,000, compared with the foreign chemical trade of this country for the same year amounting to $171,000,000; of England totaling $125,500,000, and of France, $114,000,000.

In 1926 Germany's chemical exports were more than double both France's and England's trade. During the past two years the depreciated value of the French currency and economic difficulties, such as the coal strike in England, have had an adverse effect on the chemical trade of the two countries. Even so, however, the report states, it is doubtful just how much more of the trade those countries would have procured under slightly different circumstances.

Germany's rapid ascendancy to this high position may be attributed largely to, first, a more extensive world consumption of chemicals in general, and, second, the development of a big export business in several commodities, particularly ammonium sulphate and synthetic methanol.

During this five-year period the United States has gained 40 per cent, it is true, yet this rate is much lower than it should be, it is pointed out, especially when it is considered that the United States is not only the world's largest producer and consumer, but also the world's largest importer of chemicals, and that in 1925 only 7½ per cent of its total chemical production was exported.

BRITISH ASSOCIATION PROGRAM FEATURES TEXTILE CHEMISTRY

The annual meeting of the British Association for the Advancement of Science has been in session at Leeds, England, since last Wednesday, August 31, and will adjourn on Wednesday of this week. As the locality chosen for its meeting is a great textile center, the council has provided an important series of papers dealing with many subjects directly related to textile technology.

The program includes a number of papers on textile chemical problems and on the action of dyes. The authors and titles of these papers are as follows:

Dr. S. G. Barker, Fading of Dyestuffs; Dr. J. J. Hedges, Moisture Relations of Colloidal Fibers; A. T. King, The Chemical Aspect of Wool Research; H. R. Hirst, Use of Ultra-Violet Radiation in Textile Analysis; J. E. Nichols, Colored Fibers in the Fleece; J. B. Speakman, The Intracellular Structure of the Wool Fiber; A. N. Shimmin, Some Economic Aspects of the Growth and Distribution for Manufacturing Purposes of the Wools of the World; F. T. Pierce, Problems of Textile Testing—(a) Variability; (b) Time Effects; Dr. Barr and Miss Hadfield, Nature of the Action of Sunlight on Cotton; A. L. Wykes, Quantitative Determination of the Physical Properties of Artificial Silk and their Relationship to Textile Manufacture; Dr. E. Griffiths, Air Conditioning; Dr. L. L. Lloyd, Rancidification and Oxidation of Olive Oil; Dr. Alfred Perl, Manufacture of Viscose (Artificial Silk), Parallel Bobbin and Centrifugal Systems (Illustrated by Film).

RELATION OF NEW YORK UNIVERSITY TO CITY TRADES EXPLAINED AT EDITORS' LUNCHEON

Percy S. Straus, vice-president of R. H. Macy & Company, acting in his capacity as chairman of the Executive Committee of the Centennial Fund of New York University, was host August 23, at one of a series of luncheons which he is giving to editors of leading trade publications.

Mr. Straus, Dr. Ellsworth Brown, Chancellor of New York University, and Professor Philip O. Badger, general manager of the Centennial Fund, were the principal speakers. Forty were present at the luncheon.

Mr. Straus stressed in particular the interrelations of the University and the businesses and professions of this city. Enlarging on this theme, he said: "There is nothing artificial in these contacts of City and University. They are a steady outgrowth of principles and plans which were enunciated when the University was founded almost a century ago. It was the hope of the founders. They came out for the promotion of scientific methods in all our activities at a time when science and industry were looked down upon by the general academic world.

"What is the result of their foresight? To-day New York University has eleven degree-granting schools and colleges and six non-degree-granting units, situated at four centers of the city. In the academic year 1926-27, the University had 32,000 students enrolled for full or part-time work and a faculty of more than twelve hundred. The application of scientific methods to business and the professions for which the founders contended is seen in amazing variety."

The vice-chairman of the Executive Committee of the Centennial Fund is Dr. William H. Nichols, who is chairman of the Board of the Allied Chemical and Dye Corporation.

Rice hulls are now being used as a source of cellulose, the principle raw material of the rayon industry.

MILLS AND MEN

The Bellman Brook Bleachery Company, Fairview, N. J., is having plans prepared for a one-story brick addition, for which bids will soon be asked. Frank A. Moore, 607 Fifth Avenue, New York, is the architect.

The Richards Chemical Works, Jersey City, N. J., is completing plans for the erection of a new four-story plant, 100 by 250 feet, at Warren and Sussex Streets, to be used primarily for the production of chemicals for renovating silks, reported to cost in excess of $100,000. Facilities will be provided for the employment of about 300 persons.

The Tubize Artificial Silk Company is starting construction of an addition to its plant at Hopewell, Va., which will eventually double the capacity of the plant. The output is running at a rate of 7,000,000 pounds of rayon annually. The company is specializing in making fine sizes of thread and is now producing 35-denier, the finest size thread rayon ever made, it is said.

H. A. Newton, formerly with the Pacific Mills, Columbia, S. C., but more recently general superintendent of the Pacific Mills, Coheco plant, Dover, N. H., will hereafter be general superintendent of the Pacific Mills at Lawrence, Mass.

J. A. Pinatel, formerly president of the Plymouth Silk Dyeing & Finishing Company, Easton, Pa., is now with the Strengs Piece Dyeing & Finishing Company, Paterson, N. J., as vice-president and assistant manager.

The American Aniline Products Company, New York, will erect an addition to its plant at Lock Haven, Pa., costing $200,000 and providing for greatly increased production.

From one ton of corncobs distilled recently at the University of Minnesota, 5,843 feet of combustible gas, 76.2 pounds of acetic acid, 24 pounds of methanol, 140 pounds of wood tar and 622 pounds of charcoal were recovered.

The Empire Piece Dyeing & Finishing Company, Paterson, N. J., has taken out a permit for the erection of a one-story boiler house at 109 East Nineteenth Street.

The Grasselli Dyestuffs Corporation is to erect an addition to its plant at Grasselli, N. J., costing $200,000.

The Valley Finishing Company, Pleasant Valley, N. Y., has just completed the installation of all of its new silk and rayon finishing equipment. The new storehouse has also been completed.

J. H. Schaller, superintendent of the cotton goods bleachery of Cluett, Peabody & Co., Waterford, N. Y., has returned from an extended sojourn in Europe.

The Phillipsburg (N. J.) Dyeing & Finishing Company, dyers and finishers of silk and silk mixed goods, has recently installed new finishing equipment which increases its former capacity considerably. The company is actively engaged and reports receipt of a good volume of business at present.

DEPRESSION IN JAPANESE CHEMICAL INDUSTRY

The Japan Chemical Industry Society has organized an investigation commission which adopted a resolution to the effect that the Japanese chemical industry is sorely depressed, in striking contrast to the progress made by Germany and elsewhere since the termination of the World War. The commission wants the sphere of the market extended and price competition eliminated. It is investigating industrial chemicals and drugs, caustic soda and soda ash, artificial fertilizers, leather, ceramic products, coal, gas and coal tar, dyestuffs and synehtetic spices, petroleum, synthetic oils, lacquer, toilet soaps, celluloid, rayon, paper, brewing, rubber and acetic acid.

The rate for "Position Wanted" advertisements in this column is 2 cents a word—with a minimum of 50 cents per insertion. For all other types of advertisements—i. e., help wanted, machinery or supplies for sale—the rate is $5.00 per column inch or less per insertion.

DYESTUFF CHEMIST

Dyestuff chemist, 34, married; over ten years' experience, six years in charge manufacturing meta and para toluylenediamine, Naphthol Green, azo colors and intermediates; also some vat color experience; desires permanent connection with chance of advancement commensurate with ability. Salary $50. Address Classified Box 410, American Dyestuff Reporter.

DYE CHEMIST

Chemist with practical experience in the manufacture of alizarine or vat colors is required by domestic manufacturer of these colors. Please state general qualifications, experience, age, salary desired. Address Classified Box 413, American Dyestuff Reporter.

BLEACHERY SUPERINTENDENT

M. I. T. graduate; wide and thorough practical experience in bleaching, dyeing and finishing; experienced vat dyer; well versed in modern management principles; seeks an exacting job with a progressive concern. Address Classified Box 417, American Dyestuff Reporter.